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ABSTRACT

A review of space and utilization standards in California public higher education culminated in several principles that should govern the changes in space and utilization standards generally. These principles were as follows: (1) changes should be conceptually simple, consolidating various formulaic elements into single standards wherever possible; (2) at the state level, changes should be administered flexibly, thereby encouraging creativity at the campus and system-wide levels; (3) changes should be interpreted broadly and not become highly specific design standards where the exact sizes of rooms are dictated without regard to need or function; (4) changes should encourage balance among all physical facilities; (5) they should be accompanied by strong accountability and reporting requirements; (6) they should be reviewed on a regular basis; and (7) they should not be changed unless a compelling case for change can be demonstrated. Recommendations on the basis of these principles called for a modest relaxation in the current classroom standard and, in particular, the utilization component of that standard; virtually no change in teaching laboratory standards; a continuation of current practice in the funding of University of California research space; and some improvements in faculty offices. Regular classroom and teaching laboratory utilization reports were also recommended. The text of "Time and Territory: Phase II," published as Report 86-12, is reproduced in an appendix. Twenty-four references are provided. (GLR)

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A CAPACITY FOR LEARNING

Revising Space and Utilization Standards for California Public Higher Education

HE 24 3727

CALIFORNIA POSTSECONDARY EDUCATION COMMISSION

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Summary

This is the final report for the Commission's review of space and utilization standards in California public higher education. It represents the culmination of a process that began in 1985 and that involved a major effort by the Commission; the Commission's consultants, [illegible]f, Inc.; and an advisory committee with membership from the Department of Finance, the Legislative Analyst, and the segments.

The report contains an executive summary that lists conclusions and recommendations, a background statement and history of space and utilization standards in California, a description of the consultants' work on the national survey and changes in academic disciplines, and four chapters analyzing specific space requirements for classrooms, teaching laboratories, research areas, and faculty offices.

The report offers a number of principles that should govern changes in space and utilization standards generally: (1) they should be conceptually simple, consolidating various formulaic elements into single standards wherever possible; (2) at the State level, they should be administered flexibly, thereby encouraging creativity at the campus and systemwide levels; (3) they should be interpreted broadly and not become highly specific design standards where the exact sizes of rooms are dictated without regard to need or function; (4) they should encourage balance among all physical facilities; (5) they should be accompanied by strong accountability and reporting requirements; 6) they should be reviewed on a regular basis; and (7) they should not be changed unless a compelling case for change can be demonstrated.

Using these principles, the Commission recommends a modest relaxation in the current classroom standard and -- in particular -- the utilization component of that standard; virtually no change in teaching laboratory standards; a continuation of current practice in the funding of University of California research space; and some improvements in faculty offices -- particularly for the California Community Colleges. It also recommends the submission of regular classroom and teaching laboratory utilization reports from each of the segments and the establishment of the Commission's Advisory Committee on Space and Utilization Standards as a permanent forum for the discussion of problems and needed adjustments in the standards.

The Commission adopted this report at its meeting on January 22, 1990, on recommendation of its Policy Development Committee. Additional copies may be obtained from the Publications Office of the Commission at (916) 324-4991. Questions about the substance of the report may be directed to William L. Storey, the Commission's Assistant Director for Finance and Facilities, at (916) 322-8018.

A CAPACITY FOR LEARNING

Revising Space and Utilization Standards for California Public Higher Education

CALIFORNIA POSTSECONDARY EDUCATION COMMISSION
Third Floor • 1020 Twelfth Street • Sacramento, California 95814-3985

COMMISSION REPORT 90-3
PUBLISHED JANUARY 1990

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In the Commission's view, MGT's work on this project has been both diligent and creative, thanks in large part to the dedication of Ken Boutwell of Tallahassee, Florida, the firm's president, and Stan Anderson, Vice President and director of MGT's regional office in Sacramento. Denis Curry, Senior Consultant and director of MGT's office in Olympia, Washington, also deserves special mention. All three of these men demonstrated a generosity with their time that far exceeded the terms of the contract.

The Advisory Committee met on 22 occasions beginning in 1985, and a few people attended virtually all of those meetings, including Clarence Mangham of the California Community Colleges, Sheila Chaffin and Jon Regnier of the California State University, Trudis Heinecke and Joanne Cate of the University of California, and Jordan Montano of the Department of Finance.

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Few facilities planners are more conversant with the arcane terminology of space and utilization standards than Jon Regnier, Associate Vice President at California State University, Long Beach. Mr. Regnier served on the Advisory Committee not only as a representative of the State University system but also as someone uniquely qualified to discuss the complexities of capital planning on a large urban campus. His knowledge of the mechanics of the planning process, his understanding of how classrooms and laboratories are used, and his long institutional memory were of great assistance.

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1 Summary, Conclusions, and Recommendations

Summary of the report

Supplemental Budget Language approved by the Legislature in 1985 directed the California Postsecondary Education Commission to conduct a preliminary exploration of space and utilization standards for classrooms, laboratories, and faculty offices. That directive led to the Commission's publication of *Time and Territory* (February 1986) and *Time and Territory: Phase II* (April 1986) -- two exploratory reports that marked the first examination of the subject in 20 years.

In 1987, the Legislature determined that further research on the subject was needed and to this end appropriated $300,000 to the Commission for the purpose of conducting a more comprehensive analysis. With that funding, the Commission retained MGT Consultants, Inc., to perform three tasks:

1. Conduct a survey of space and utilization standards in other states;
2. Examine existing inventories and utilization studies in California's public segments; and
3. Attempt to determine how various academic disciplines have changed in the past several decades and what impact those changes have had on space needs.

MGT's work on the project, which is discussed at length within the body of this report, was guided by the Commission's Advisory Committee on Space and Utilization Standards, whose members are listed on the opposite page. During 1989, the consultants submitted three reports to the committee that became the subject of extensive discussion and that formed the basis of this culminating report. While this document is thus the result of the efforts of many individuals, the results of the project remain solely the Commission's responsibility.

Importance of space and utilization standards

Space and utilization standards are a subject of vast scope and complexity, and past efforts to determine appropriate standards have often required years of work by dozens of professionals. The Commission's current project involved no less work than past explorations of the subject, but has gained considerably from all previous efforts.

A major finding of this study is that virtually all space standards tend to increase in detail and complexity over time and that -- perhaps because of some fundamental quality of human nature -- there is a tendency to try to draw greater and greater precision out of formulas that were never intended to be anything more than general guidelines. The result is often an architectural and academic straitjacket -- a planning system that assumes too much from mathematics and that fails to account for the fact that campuses are systems of buildings that must work together if the entire enterprise is to function effectively. Drastically limiting the amount of space that can be built in one category can have hidden effects on other space types, resulting in such unexpected and unwanted results as overcrowding, the construction of unneeded or overly expensive facilities, and a general reduction in campus morale.

Despite this unfortunate tendency, the Commission believes that space standards, when prudently formulated and applied, provide very useful tools to both State-level policy makers and capital outlay planners. No one doubts that both the Governor and the Legislature have the responsibility for assuring that capital resources are wisely expended, and to that end, must impose limitations on the desires of academic planners. In addition, State policy makers should endeavor to allocate resources fairly to all segments of higher education, to assure that one segment does not gain an undue advantage over another. Thirdly, the State should be reasonably confident that facilities are meeting actual needs, that they are neither luxurious nor inadequate. Space standards can be extremely useful in meeting these objectives, provided they do not become overly

prescriptive. Used broadly, they can define the limitations of the physical plant, allow for balance among various room types, and permit the even distribution of scarce resources. Used narrowly, they can stifle creativity, create imbalances in the total physical plant, and encourage a slavish adherence to a theoretical precision that hardly ever exists in reality.

It may be frustrating to realize that precise formulations cannot be imposed on the business of capital construction on all campuses in all segments, but the Commission believes that California's system of higher education is so vast, so diverse, so complex, and so variable in segmental missions and functions that it is unwise, if not impossible, to impose identical space and utilization standards on all segments from the State level.

Principles for space and utilization standards

It appears to the Commission that a viable array of space and utilization standards for California public higher education must be based on three principles:

1. Standards should not be changed unless the arguments for change are compelling;
2. They should be simple and flexible; and
3. They should be reviewed on a more or less regular basis.

In this report, the Commission has recommended alterations in the State's existing standards only when merited by programmatic needs, while simultaneously reducing much of the unnecessary complexity and detail that presently characterizes them. As will be seen on pages 10 and 11 below, the new standards for teaching laboratories are almost unchanged from existing ones. For research space, the new standards represent an increase over those that have been in existence since 1955 but simultaneously represent almost no change from space allocations approved in funded projects over the past five or six years. In other cases, however -- particularly classrooms in general and faculty offices in the community colleges -- the Commission found that significant improvements were essential and consequently strongly recommends major changes.

Concerning simplicity and flexibility, current lecture room standards involve square-foot-per-station space limitations, a utilization standard with three components, and a third factor for service and stor age areas. The Commission proposes combining all of these standards into a single factor and making similar consolidations for other types of space. It believes that this streamlining will go a long way towards according campus planners the flexibility they need to tailor facilities to the exact needs of academic departments.

Some members of the Advisory Committee were concerned that liberalizing the classroom standard will produce undue burdens on capital outlay budgets. The Commission is persuaded that this will not happen. While it is virtually certain that additional classrooms will be built as a result of the new standards, the net result is likely to be a reduction in pressure on teaching laboratories and other facilities. Since lecture spaces are the least expensive type of instructional space to build, the overall effect of the more generous classroom standards will probably be the construction of a greater total amount of square feet within a given level of capital outlay appropriation, with a proportionate increase in real capacity.

Equally important is the fact that capital outlay appropriation levels are seldom determined by space and utilization standards. Far more often they are governed by external factors such as the willingness of voters to approve bond issues, the ability of the State to sell bonds, and the competing requests of other State agencies. Recently, for example, the State Treasurer indicated that California could remain fiscally responsible if it sold some $4 billion worth of bonds per year for all purposes, including school, college, university, prison, highway, and other construction; but he also stated that the bond market can probably absorb no more than $2 billion. This limit alone will restrict higher education capital outlay budgets severely and force the segments to reprioritize their requests, not expand them. Further, since no segment ever receives the full extent of its request even now, it is virtually certain that expanded requests will not be fully approved by the Governor and the Legislature.

Another concern is that changes in the classroom standards will alter campus capacity figures so substantially that it will become necessary to build a greater number of new campuses in the future than would have been the case had the standards not been changed. This view also appears to be doubt-

ful. While it is true that listed campus capacities in all three segments are, in part, a reflection of the classroom standard, and particularly the utilization component of that standard, *actual* capacity is not a function of the standard but of *actual* utilization. To offer an example, if the current classroom utilization standard of 35 weekly station hours per week were increased by 20 percent to 42 hours, it might appear that campus lecture capacity would automatically be increased by a like amount, thereby raising a campus with a lecture capacity of 10,000 full-time-equivalent students to 12,000. In fact, no increase in actual capacity would occur, since it would not be possible to use classrooms at the rate called for in the new standard.

Conversely, if lecture stations are actually in use for 30 hours per week, it makes no difference what standard is stated on paper, for actual capacity is always determined by the maximum number of students that can actually be taught. Accordingly, the adoption of a standard that is not closely related to reality only serves to convey a false impression of the number of students that can be educated within a given physical plant. In the case at hand, the 35-hour standard has done precisely that, and, because its primary effect has been to prevent the construction of needed classroom facilities, it has also created pressures to construct other facilities that either are not subject to any space standard or are governed by more reasonable standards, for only in this way can the classroom overflow be accommodated. A revision of the classroom standard to reflect the very high utilization rates currently being achieved in all three segments will permit classroom facilities to grow with enrollments, and simultaneously reduce the incentive to build more expensive space.

As to the campus capacity figures themselves, they need not be changed. Since these capacities are largely a function of lecture space, the construction of some additional classroom space will permit the currently listed capacities of campuses to remain where they are.

In the case of faculty offices, a question that Commission staff put to faculty members throughout the State was whether they would prefer a new office immediately under the existing standards or wait a year or two for more adequate facilities to be built under the new standards. In every case, these faculty preferred to wait, since virtually all of them stated that the existing standards produce offices that are inadequate to meet their needs. Indeed, the Commission found a great degree of realism in the faculty's perceptions -- an understanding that the total level of capital appropriations is determined much more by the State's fiscal realities than by the perceived needs of segmental planners.

Based on the three principles stated on the opposite page, the Commission offers the following 35 conclusions and 31 recommendations with the firm conviction that the new standards will have little, if any, effect on the State treasury but a considerable positive effect on the quality and efficiency of physical plants throughout the State.

Conclusions

General

1. Reporting procedures among the segments are of uneven quality and consistency. Presently, the California State University produces excellent utilization reports on both classrooms and teaching laboratories, but no utilization reports are produced in the community colleges. University of California campuses conduct utilization studies of classroom space, mostly in conjunction with the preparation of project planning guides for specific projects, but the data are not collected routinely or consistently.

2. A viable and efficient space management system requires the periodic compilation of comprehensive classroom and teaching laboratory utilization data. Currently, those data are developed only by the California State University, but they should be developed by all three segments. The State University currently produces utilization data annually, which, given the fact that usage patterns change slowly, is probably unnecessary on so regular a basis. A biennial report by each of the segments will adequately serve the purpose.

3. The California Community Colleges are the least able to compile comprehensive utilization reports, in part because of staff limitations in the Chancellor's Office, and in part because of the very large number of campuses within the Community College system. For the Chancel-

lor's Office to develop adequate utilization reports, additional staff resources within the Chancellor's Office capital outlay unit will be required.

4. The issue of which room types should be subject to standards, and which should be left outside of standards and supported on an individual justification basis, has not been reviewed for many years. This issue is particularly germane to the subjects of teaching and research laboratories.

5. Flexibility is a crucial ingredient in the administration of any space or utilization standard. California's institutions differ in mission, function, and disciplinary emphasis, and campus administrators need to be able to plan for specific needs within the overall restrictions of the standards. A strict interpretation of the standards, one that imposes itself on design considerations, stifles creativity and flexibility, and can result in the design of rooms and buildings that serve the campus community poorly. Effective planning requires an evaluation of the role and function of all facilities on a campus, and consequently dictates the conclusion that space standards should be applied, within each space category, on a campus-wide basis.

6. One of the ways in which greater accountability and flexibility can be obtained is to assure that both State control agencies and the segments have the opportunity to confer on space and utilization standards issues on a regular basis within a structured setting. Campus conditions change over time, with alterations in academic emphasis, updates in building and safety codes, and changes in daytime versus evening attendance patterns. Some of these changes may warrant adjustments in the standards, and it is therefore prudent to establish a permanent body of responsible officials to review the standards on a regular basis.

Classrooms

7. The national survey of space standards developed by MGT showed that California's classroom standards are the most restrictive in the nation, particularly for the four-year institutions.

8. The 56.3 percent increase in classroom utilization that was legislated by Assembly Concurrent Resolution 151 in 1970, which consequently increased full-time-equivalent teaching capacity by a similar amount but did not make necessary adjustments in other kinds of space, resulted in unforeseen burdens in laboratory, office, library, and administrative areas. Over time, these latter areas were expanded without the addition of new classrooms, which in turn created pressures on classroom scheduling.

9. One of the basic assumptions behind Assembly Concurrent Resolution 151 -- that classrooms could be used in the evening at the same rate as during the day (75 percent of the available hours) -- was probably unreasonable, particularly for the University of California. Nevertheless, this encouraged campus administrators and faculty to support greater evening attendance, and may also have been prescient in the sense that it anticipated a major expansion in the enrollment of part-time students, most of whom attend the community colleges and the State University in the evening.

10. Although its classroom standards are highly restrictive, California has also demonstrated, to a degree virtually unknown in the rest of the country, that very high classroom utilization can be achieved. It is now apparent that the standard established in 1970 was too extreme, but the experiment itself was nevertheless successful in demonstrating that classrooms can be used with far greater frequency than was perceived to be possible in the 1960s and earlier.

11. The national survey, segmental inventories, and related data indicate that on campuses where small classrooms predominate (viz. the State University and the community colleges) a more liberal square footage standard per student station is required. On campuses with larger classrooms (viz. the University of California), it is possible to operate effectively with fewer square feet per station.

12. The California State University and the California Community Colleges, because their missions encourage large evening programs, will have a much easier time meeting any classroom

utilization standard than will the University of California. Thus, while the preponderance of small classrooms will create a handicap relative to the space per station element of the standard, that handicap can be largely canceled by greater utilization. Similarly, any difficulty the University of California may encounter in meeting the utilization component can be largely offset by a space per station standard that is slightly more generous than required.

13. Classroom service/storage space appears to be inadequate in all of the segments, particularly in the community colleges where there is no allowance in the current standard. In the future, it seems apparent that the need for auxiliary space will grow, particularly because of the increasing use of electronic and video equipment, new safety requirements, and the need for set-up or preparation areas. A major adjustment in this category is necessary for the community colleges, with lesser adjustments for the four-year segments.

Teaching laboratories

14. Based on the data developed by MGT, California employs more rigorous utilization standards than other states, although not by nearly as wide a margin as for classrooms.

15. In spite of California's tighter utilization requirements, the utilization standards originally developed by the Coordinating Council in 1966, and tightened by 10 percent by the Legislature in 1973, do not appear to have produced unreachable usage requirements. The only exception to this may be the lower-division utilization standard for the community colleges, which is the most restrictive in the nation.

16. California's four-year segments rank among the lowest in the nation in terms of the assignable square feet per student contact hour generated by existing teaching laboratory standards. At the lower-division level, they rank fourteenth out of 15 surveyed states. At the upper-division level, they rank eleventh out of 15. In both cases, the stringency of the utilization component of the standard is the primary reason for the low ranking.

17. The California Community Colleges rank third out of the nine states (including California) that supplied data, in spite of the fact that the two-year institutions employ the most stringent of all the utilization standards in use nationally. The primary reason for this seeming anomaly is that the colleges have a large number of vocational laboratories that require large space-per-station allocations.

18. The rationale employed by the Coordinating Council to establish differential utilization standards for the lower- and upper-division levels no longer appears to be objectively justifiable. Most of the surveyed states (11 of 14) use only one utilization standard for all levels of instruction. Recent utilization data from the State University also indicate that the difference in actual utilization between the two levels is not as great as originally projected in 1966. In addition, the existence of differential formulas may provide an unintended incentive to build upper-division laboratory space, since the standard for that space is more generous.

19. Teaching laboratory utilization data from the California State University indicate that, although the utilization standards are restrictive by national norms, the State University is nevertheless able to meet or exceed them. As an example, when the utilization standards achieved at each level of instruction are weighted by the number of laboratories at each level, the State University achieves an overall utilization rate of 20.8 weekly station hours; the existing composite standard is 19.6.

20. Teaching laboratory utilization in the State University is similar, but not identical, to the pattern shown for classrooms. Utilization during most daytime hours is very high, exceeding the standard by a wide margin at both the lower- and upper-division levels. In the evenings and on Fridays, however, there is a considerable fall-off.

21. There is a growing national consensus that space formulas for teaching laboratories should

be simpler. Where California currently uses a wide variety of space per station standards arranged by discipline, many states use only one or two such standards for all disciplines. In addition, where California adds a specific factor for service and storage areas, most states include that factor within their overall allowance, Nebraska being the only exception. Simplification of the formulas tends to discourage their use as design standards, and consequently permits greater flexibility than is currently available. Such flexibility should permit buildings to be tailored more closely to actual needs.

22. In spite of the fact that California's standards provide relatively less square feet per contact hour than other states, it seems prudent to maintain them at approximately their current level. This should be possible because California -- at least in the State University -- has demonstrated that a higher than average utilization standard can be achieved -- a circumstance that probably holds true for the Community Colleges as well, given the similar balance between daytime and evening instruction there. In addition, since most of the current standard is achieved during the daytime hours, it may well be possible for the University of California to achieve it as well.

23. Some minor changes in the space per station standards for teaching laboratories should be approved. From the focus groups, it is clear that many needs have changed in the past 20 to 30 years and that a number of adjustments should accordingly be made. In some cases, these changes will cancel each other out. In cases where they do not, there is room to increase the composite utilization standard (lower-division, upper-division, and graduate combined) to maintain a status quo, or nearly status quo, condition.

24. At the University of California, the absence of systemwide contact hour data makes it virtually impossible to render an accurate comparison between the existing standards and any new proposal. It will not be possible to determine the true effect of any new standards until the University completes its first report on actual contact hour experience in its class laboratories. At such time as this report is received, adjustments may be necessary.

Research space

25. In the future, this category should be identified as "research space," rather than "research laboratories." Throughout this investigation, it has become clear that not all research is conducted in laboratories. With the advent of the computer, research in many fields is now conducted in offices or office-type facilities. While separate standards for faculty offices are still necessary, the research space standards proposed in this report take into account the fact that it is virtually impossible to separate the space needs of graduate students into office and laboratory components.

26. California's 1955 research space standards diverge substantially from those in the surveyed states, with the national mean exceeding those standards by a margin of 25.1 percent. Given the facts that California's standards are over 30 years old, that many changes have occurred in the way research is conducted, and that every state surveyed has updated its standards more recently, such a divergence is to be expected.

27. The standards for research space developed in 1955 are obsolete and should be replaced. The primary reasons for this obsolescence include the existence of research teams (including postdoctoral fellows) rather than individual researchers, larger equipment inventories, and health and safety requirements. The fact that the old standards are obsolete has already been recognized by the Governor and the Legislature in their approval of projects for University of California research space that substantially exceed the old standards.

28. The existing standards for research space should be simplified wherever possible. To do so, the current allowances for service and support areas should be included within the overall assignable square foot allowances for individual researchers.

29. The total amount of research space generated by the new standards should not diverge significantly from national norms. In what is expect-

ed to become an increasingly competitive faculty recruiting environment in the 1990s, California should be willing to provide research facilities that generally parallel national standards.

30. Postdoctoral fellows should be formally recognized in research space standards. Not only are they highly qualified professionals in their own right, they play a critical role in the University's research mission, and have become permanent contributors to this mission. Today, especially in the sciences and engineering, postdoctoral experience is virtually mandatory for appointment to a faculty position. If the University is to maintain the preeminence of its faculty, it is apparent that the existence of postdoctoral education should be formally recognized.

31. While the addition of postdoctoral fellows to the standards represents a significant departure from past practice, including them has virtually no effect on the total amount of research space that has actually been approved by the Governor and the Legislature over the past six years. The primary reason for this is that postdoctoral fellows have already received de facto recognition in capital outlay budgeting decisions.

32. It appears that the State University is assuming a greater research role, although one that is consistent with its mission and quite different from the basic research activities of the University of California. This change from the practices of earlier decades has already been recognized by the Department of Finance in a long-standing informal agreement with the State University to approve some research space for graduate students, at 75 percent of the University of California's graduate student standard, on an individual justification basis. The advisory committee concluded that this practice should be formalized in the new standards.

Faculty offices

33. Faculty office space requirements have increased in the past several decades. The primary reasons for this increase are the introduction and widespread usage of personal computers, the growth in the research function in both of the four-year segments, and, in the California Community Colleges, an increasing priority to confer with and counsel students.

34. The California Community Colleges have less space for faculty offices than any other state surveyed by MGT that uses space standards.

35. When the Coordinating Council for Higher Education developed the office standard for the two-year segment in 1966, it did not examine the question with as much care as it did for the four-year institutions, primarily because local district resources were generally sufficient to construct whatever space was needed. The Council accordingly offered only a general guideline, one that evolved into a prescriptive standard between the late 1960s and the present.

Recommendations

General

1. **The Advisory Committee on Space and Utilization Standards should be constituted as a permanent advisory committee of the California Postsecondary Education Commission. Similar to several of the Commission's other permanent advisory committees, this committee should meet as often as its members deem reasonable and prudent.**

2. **The Office of the President of the University of California, the Office of the Chancellor of the California State University, and the Chancellor's Office of the California Community Colleges should each present a biennial classroom and teaching laboratory utilization report for all campuses to the Department of Finance, the Office of the Legislative Analyst, and the California Postsecondary Education Commission. This report should be based on actual weekly-student-contact-hour counts. Each of the segments should advise the above named recipient agencies by no later than July 1, 1990, concerning the specific con-**

tents of and submission date for the first of these reports.

3. The Office of the President of the University of California, the Office of the Chancellor of the California State University, and the Chancellor's Office of the California Community Colleges should each present a report to the Department of Finance, the Office of the Legislative Analyst, and the California Postsecondary Education Commission on the subject of "standard" versus "non-standard" space. This report should contain recommendations concerning room types to be placed within or outside of the requirements of the space standards, the latter to be submitted for approval on an individual justification basis in all future budget requests. Where changes in the existing categories are recommended, a complete justification for the change shall be included. This report shall be submitted to the above named recipient agencies by January 1, 1991.

4. The Governor and the Legislature should approve funding for several new positions in the Community Colleges' Chancellor's Office capital outlay unit for the purpose of developing comprehensive classroom and teaching laboratory utilization reports for each of the 71 districts in the system.

5. All future adjustments in space and utilization standards for California higher education facilities should be governed by the principles of simplicity and flexibility. To that end, space standards should be applied on a campus-wide basis in each space category, with the space standards considered to be campus-wide averages and not design criteria for specific projects.

Classrooms

6. The classroom space standard for the University of California, the California State University, and the California Community Colleges, should be .55 assignable square feet per weekly student contact hour. The components of this standard are detailed in Recommendations 7 through 9 for illustrative purposes only, and should not be interpreted as elements to be applied to specific projects by planners or policy makers.

7. The space per station element of the standard should remain at 15 assignable square feet.

8. The utilization element of the standard should be changed from the current level of 35 weekly station hours -- the product of 53 weekly room hours with a 66 percent station occupancy percentage -- to a weekly-station-hour level of 30. Such a change would continue to give California the strictest standards in the nation for the four-year segments, and among the strictest for the Community Colleges. This standard will still produce between 14 and 37 percent less space, depending on the segment, than the standards used by other states.

9. The service and storage area element of the standards should be set at 10 percent of the total assignable square feet produced by Recommendations 7 and 8.

Teaching laboratories

10. Teaching laboratory space standards for the California Community Colleges should be set at the assignable square feet per weekly student contact hour levels specified below, including all support and service areas. The elements of each of the five standards are based on the array in Display 60 on page 85 of this report and are shown in that display for illustrative purposes only. Display 60 contains laboratory categories of 33, 45, 65, 120, and 185 assignable square feet per station. A utilization rate of 27 weekly room hours at 80 percent station occupancy (21.6 weekly station hours) is applied to each category.

Category	Assignable Square Feet per Weekly Student Contact Hour
I	1.528
II	2.083
III	3.009
IV	5.556
V	8.565

11. **Teaching laboratory space standards for the California State University, at all levels of instruction (lower division, upper division, and graduate), should be set at the assignable square feet per weekly student contact hour levels specified below, including all support and service areas. The elements of each of the five standards are based on the arrays in Displays 62 through 65 on pages 87-90 of this report and are shown in those displays for illustrative purposes only. They contain laboratory categories of 35, 50, 65, 85, and 110 assignable square feet per station. A utilization rate of 25 weekly room hours at 80 percent station occupancy (20 weekly station hours) is applied to each category at all levels of instruction.**

Category	Assignable Square Feet per Weekly Student Contact Hour
I	1.750
II	2.500
III	3.250
IV	4.250
V	5.500

12. **Teaching laboratory space standards for the University of California, at all levels of instruction (lower division, upper division, and graduate), should be set at the assignable square feet per weekly student contact hour levels specified below, including all support and service areas. The elements of each of the five standards are based on the arrays in Displays 68 through 71 on pages 93-96 of this report and are shown in those displays for illustrative purposes only. They contain laboratory categories of 40, 50, 60, 75, and 90 assignable square feet per station. A utilization rate of 25 weekly room hours at 80 percent station occupancy (20 weekly station hours) is applied to each category at all levels of instruction.**

Category	Assignable Square Feet per Weekly Student Contact Hour
I	2.000
II	2.500
III	3.000
IV	3.750
V	4.500

13. **Extraordinary circumstances will occasionally require some exceptions to be made. Each of the segments maintains some highly specialized and limited use facilities such as wind tunnels, wave flumes, seismic structures laboratories, and performing arts facilities, to which broad space and utilization standards are very difficult to apply. In such cases, exclusions from the standards (into "non-standard" space) should be permitted, following submission of specific justifications.**

Research space

14. **Research space standards at the University of California should be determined by the size and type of facility in use, and not necessarily by the type of discipline. To that end, the six research space types shown in Display 80 on page 109 of this report should be adopted as the standard categories for research space.**

15. **Research space at the University of California should be provided for three basic types of research personnel: (1) State-supported faculty; (2) graduate students; and (3) postdoctoral fellows. The specific space per station allowances for these personnel should be those shown in Display 80 of this report.**

16. **Graduate student offices should be considered as research areas, with space for those offices to be taken from the total amount of research space generated by the standards shown in Display 80.**

17. **The California State University should be allowed 75 percent of the University of California's research space allowance for graduate students, provided each project providing research space is individually justified on a programmatic basis. The space generated by the standards should range between 37.5 and 187.5 assignable square feet per full-time-equivalent graduate student (75 percent of the University of Cali-**

fornia standards), depending on the type of laboratory/office space constructed.

Faculty offices

CALIFORNIA COMMUNITY COLLEGES

18. The office standard for the California Community Colleges, which currently includes both academic and non-academic administrative areas, should be separated into two categories, one for academic administration, and another for all other administrative purposes, including campus and district administrative facilities.

19. The Chancellor's Office of the California Community Colleges should develop precise definitions of "academic administration," and "non-academic administration." Within that report, the Chancellor's Office should also submit its recommendations for space allowances in the "non-academic administration" category. The Chancellor's Office should submit this report to the Commission and the membership of the Advisory Committee by January 1, 1991.

20. The space allowances generated for "academic administration" should be based on a space standard of 150 assignable square feet per full-time-equivalent faculty member.

21. Space standards for "non-academic administration" should be reviewed by the Advisory Committee on Space and Utilization Standards following submission of the report specified in Recommendation 19, and then approved by the Commission.

22. The existing standard of 160 assignable square feet per full-time-equivalent faculty member for small colleges (California Administrative Code, Title 5, Section 57029) should be abolished. Should a small college demonstrate an exceptional need, the Chancellor's Office should rely on the provisions of Title 5, Section 57020, which provides for negotiations between the Community Colleges and the Department of Finance in extraordinary circumstances.

23. The Board of Governors should endeavor, in future capital outlay budget requests, to provide for single-occupancy offices for its full-time faculty, and should establish internal guidelines for multiple occupancy offices for part-time faculty.

THE CALIFORNIA STATE UNIVERSITY

24. The existing office space standards for the California State University should be changed to a single allowance of 175 assignable square feet per full-time-equivalent faculty member for all academic administrative purposes.

25. The 175 assignable-square-feet standard should apply to office or other administrative space for all academic personnel through department chairs, and all service, storage, or support needs currently included within the existing standards for faculty offices.

26. The Trustees' policy of providing for single offices for full-time faculty members (State University Administrative Manual, Section 9611.01) should be continued, and the State University should endeavor to convert multiple offices currently used by full-time faculty to single offices.

UNIVERSITY OF CALIFORNIA

27. The existing office space standards at the University of California should be changed to a single standard of 195 assignable square feet per full-time-equivalent faculty member.

28. The existing teaching assistant office space standards at the University of California should be changed to a single standard of 195 assignable square feet per full-time-equivalent teaching assistant.

29. A new standard for postdoctoral research fellows should be created to provide the same 195 assignable square feet per full-time-equivalent postdoctoral researcher

standard as is recommended for teaching assistants.

30. The 195 assignable-square-foot standard should apply to all office or other administrative space for all academic personnel through department chairs, as well as to all service, storage, or support needs currently included within the existing standards for faculty and teaching assistant offices.

31. The existing graduate student office standard of between 5 and 30 assignable square feet per headcount graduate student should be eliminated, with needed office areas for graduate students to be provided by the research space standards.

2 Background for the Study

The meaning of space and utilization standards

Space and utilization standards are formulas used by planners and policy makers at the State, central office, and campus levels to determine the sizes of various types of academic facilities, and the number of hours per week that classrooms and teaching laboratories are expected to be in use. In California, such standards have been in use since the 1950s, and have largely determined the physical sizes of campuses in public higher education in California. All of California's existing space and utilization standards are shown in Display 1 on pages 16-17.

Space Standards: Examples of space standards are the 15 assignable square feet per student station allowed for classrooms in all three segments, or the 60 assignable square feet per station for upper-division biological science teaching laboratories at the University of California and the California State University; and -- for University of California physical science research space -- the 250 assignable square feet per faculty member, plus another 145 assignable square feet per graduate student plus another 10 percent of the resulting total for support space.

Utilization Standards: Utilization standards apply only to classrooms and teaching laboratories and are stated in terms of weekly room hours (the number of hours a particular room is expected to be in use each week), station occupancy percentage (the percentage of available seats occupied while the room is in use), and weekly station hours (the number of seats in use in each room each week). Existing utilization standards for classrooms in all segments and at all levels (lower-division, upper-division, and graduate) are 53 weekly room hours (out of a possible 70, based on a school week extending from 8 a.m. to 10 p.m., Monday through Friday), 66 percent station occupancy, and 35 weekly station hours. The last of these factors is the most important; it is the product of weekly room hours multiplied by the station occupancy percentage. The 35 weekly station hour standard assumes that every seat in every classroom will be in use for 35 hours each week.

A final formula translates both the space standard and the utilization standard into a "space factor," which is used to determine the number of assignable square feet that can be built per weekly student contact hour of activity

Development of space standards in California

To provide a context for understanding California's current space and utilization standards, the following paragraphs offer a history of California's space standards from their creation in 1955 through the major legislative actions of the early 1970s, including a discussion of why the standards were created, the rationale for their methodology, and how their use has changed over the years. (These paragraphs represent an expansion of the historical analysis provided in Part One of the Commission's February 1986 report, *Time and Territory*.)

Differences between budgeting standards and design standards

In tracing the development of California's space standards, it is important to distinguish between "budgeting standards" and "design standards." The former phrase -- *budgeting standards* -- refers to the use of space standards as general guidelines employed by State and systemwide planners and analysts to determine overall space allocations and project budgetary totals. In contrast, *design standards* refer to very specific planning formulas that determine the exact sizes of individual rooms.

As an example, if a campus uses a classroom space standard of 15 assignable square feet per student station, a budgeting standard would determine the total amount of square feet in all classrooms on that campus, with some above it and some below. A design standard would dictate that every individual

DISPLAY 1 Current California Space and Utilization Standards

SPACE STANDARDS

Classrooms (All Levels)

	Assignable Square Feet per Station
University of California	15
The California State University	15
California Community Colleges	15

Teaching Laboratories

	Assignable Square Feet per Station	
	Lower Division	Upper Division
University of California		
Administration	33	33
Agricultural Biological Science	58	60
Agricultural Economics	33	33
Agricultural Science	60	60
Anthropology	43	45
Architecture	40	65
Arts, Performing	65	65
Arts, Visual	65	65
Biological Sciences	55	60
Computer Science	45	55
Education	40	40
Engineering Sciences	90	110
Engineering, Agricultural	90	110
Engineering, Chemical	75	90
Foreign Languages	40	40
Geography	45	50
International Relations	40	40
Journalism	40	40
Law	40	40
Letters	40	40
Library Sciences	40	40
Mathematical Sciences	30	30
Physical Sciences	60	70
Psychology	43	45
Social Ecology	45	45
Social Sciences, General	30	30
Social Welfare	30	30
Studies, Applied Behavior	40	40
Studies, Creative	40	40
Studies, Environmental	55	60
Studies, Interdisciplinary	30	30
The California State University		
Agriculture	60	60
Anthropology	42.5	45
Architecture	40	65
Area Studies	30	30
Art	65	65
Biological Science	55	60
Broadcast Communication Arts	30	60
Business Admininstration and Economics	30	30
Communications	30	30
Computer Science	49	49
Education	—	40
Engineering, Other	90	110
Fine Arts	60	80
Foreign Languages	40	40
Geography	42.5	45
Health Professions	40	50
Health Science	—	50.5
Home Economics	60	60
Humanities, General	40	40
Industrial Arts	68	82.7
Journalism	60	60
Mathematics	30	30
Physical Education	40	50
Physical Science	60	70
Psychology	40	60
Public Administration	30	30
Social Sciences, General	30	30
California Community Colleges		
Agriculture	115	
Air Conditioning	130	
Architecture	60	
Auto-Body & Fender	200	
Auto-Mechanic	200	
Auto-Technology	75	
Aviation Maintenance	175	
Biological Sciences	55	
Business and Management	30	
Carpentry	175	
Commercial Services	50	
Communications	50	
Computer and Information Science	40	
Diesel	200	
Dry-Wall	175	
Education	75	
Electricity	175	
Engineering	75	
Fine and Applied Arts	60	
Foreign Language	35	
Glazing	175	
Graphic Arts	80	
Health Services	50	
Heavy Equipment	200	
Home Economics	60	
Interdisciplinary	60	
Letters	35	
Library Science	35	
Machine Tools	90	
Masonry	175	
Mathmematics	35	
Metal Trades	90	
Millwork	90	
Painting	175	
Physical Sciences	60	
Plastering	175	
Plastics	130	
Plumbing	175	
Psychology	35	
Public Affairs and Service	50	
Refrigeration	130	
Roofing	175	
Small Engine Repair	100	
Social Sciences	35	
Stationary Engine	200	
Welding	90	

DISPLAY 1, continued

Research Laboratories	Assignable Square Feet per Full-Time-Equivalent State-Funded Faculty Member	Assignable Square Feet per State-Funded Graduate Student	Percent Additional for Service Space
University of California			
Administration	53	20	6.7
Agricultural Biological Sciences	275	165	10.0
Agricultural Economics	53	—	6.7
Agricultural Science	250	145	10.0
Anthropology	145	80	7.5
Architecture and Environmental Design	100	130	10.0
Arts, Performing	100	125	10.0
Arts, Visual	100	125	10.0
Biological Sciences	250	145	10.0
Computer Science	180	100	10.0
Education	80	20	10.0
Engineering Sciences	300	185	15.0
Engineering, Agricultural	500	285	15.0
Engineering, Chemical	275	165	12.5
Foreign Languages	40	—	5.0
Geography	145	60	7.5
International Relations	80	20	10.0
Journalism	80	—	10.0
Law	80	25	10.0
Letters	40	—	5.0
Library Science	80	20	10.0
Mathematical Sciences	60	—	5.0
Physical Science	250	145	10.0
Psychology	145	80	7.5
Social Ecology	145	80	7.5
Social Sciences, General	40	—	5.0
Social Welfare	40	20	5.0
Speech	70	63	7.5
Studies, Applied Behavioral	125	35	10.0
Studies, Creative	—	—	—
Studies, Environmental	145	60	7.5
Studies, Interdisciplinary	40	—	5.0

Note: Research laboratory standards apply only to the University of California. However, the California State University can receive research laboratory space based on 75 percent of the University of California standard and on an individual project justification basis.

Faculty Offices	Assignable Square Feet Allowed: Office	Assignable Square Feet Allowed: Support
University of California		
Faculty	138.7	39.5
Other:		
Teaching Assistants	138.7	39.5
Graduate Students (per headcount)	25.2*	
The California State University		
Faculty	118.5	34.6
California Community Colleges		
Faculty	85.0	10.0

* Office and support combined.

UTILIZATION STANDARDS

Classrooms (All Levels)	Weekly Room Hours	Station Occupancy Percentage	Weekly Station Hours
University of California	53	66%	35
The California State University	53	66%	35
California Community Colleges	53	66%	35
Teaching Laboratories			
University of California			
Lower Division	27.5	85%	23.4
Upper Division	22.0	80%	17.6
The California State University			
Lower Division	27.5	85%	23.4
Upper Division	22.0	80%	17.6
California Community Colleges			
Lower Division	27.5	85%	23.4

Source: MGT Consultants, Inc., 1989a.

classroom be built to exactly 15 assignable square feet per station. Consequently, budgeting standards connote considerable flexibility in the planning process, while design standards are more rigid.

In the late 1950s and throughout the 1960s -- an era characterized by economic growth, State fiscal strength, substantial federal contributions to higher education, and a commitment by the State to fund capital projects -- space standards provided an excellent general guide for expanding enrollment capacity. By the mid-1960s, they also assisted in expanding the California Community Colleges. In that segment, the standards were intentionally less detailed, reflecting the idea of a partial State funding scheme for instructionally related capital improvements, and assuming the retention of local control and substantial local funding for college construction projects.

The austerity of the 1970s and early 1980s, however, contributed to a series of reinterpretations of the standards that elevated them from a general planning model to a regulatory tool. To a degree, this constituted a major change in the purpose of space standards, from their traditional use as budgetary guidelines, to their use as design criteria. This change, when combined with the antiquated nature of many of the existing standards, produced confusion regarding how, and at what level of review, the standards should be applied -- as will be evident from the following chronology.

Origins of the standards in the 1955 Restudy of the Needs of California in Higher Education

Although elements of California's space standards can be found in the 1948 report by George D. Strayer and associates, *A Report on a Survey of the Needs of California in Higher Education*, the State's standards were largely created between 1953 and 1955 as part of a larger study directed by T. R. McConnell and published in 1955 as *A Restudy of the Needs of California in Higher Education*. ("Restudy" refers to the intent of the Liaison Committee of the University of California's Regents and the State Department of Education, under legislative mandate, to update the Strayer report and its findings). As with other major reports on California higher education completed in the 1950s, this formulation and adoption of space standards was a response to the massive projected growth of public higher education in California. Reflecting the funding mechanisms and jurisdictional practices of the times, the standards were intended to assess the long-term capital needs of the University of California and what is now the California State University system, based on existing building allowances developed internally within these segments. Standards for the California Community Colleges were not developed until the 1960s.

Both the development of the first statewide classroom utilization rates in 1948 and the adoption of the space standards in 1955 had one primary purpose: to provide a model for assessing the overall capital needs of each segment for budgetary planning purposes. Foreseeing huge enrollment increases, McConnell and his colleagues used existing formulas derived internally by the University and State Department of Education, as well as their respective five-year building programs, to build a model that assessed segmental enrollment capacity in 1955 and provided an approximate assessment of capital needs and costs over a 15-year period.

The need for standards was directly tied to two important contextual factors. First, California was faced with the first substantial level of debt since the Great Depression -- one that posed a threat to any large expansion of State infrastructures. Second, with the fiscal problems of the State and the political posture of Governor Goodwin Knight (1953-58) as a backdrop, the 1955 *Restudy* constituted an effort to provide the most economical way to deal with enrollment increases under the guidelines of the 1948 Strayer Report. Its recommendations that no new campuses be built until 1965, and that existing campuses be expanded, directly indicated the magnitude of both the operating and capital cost problems facing the State and, indirectly, the need for a relatively new form of school capital financing, bonds.

Of secondary importance was the use of the standards as a guide for project planning and as a benchmark through which State officials, including the Legislative Analyst's Office and the Department of Finance, could judge individual capital projects. The standards, to quote the Restudy, were to "provide the guides for determining the total net square feet of instructional and staff space required" at a campus, and within a segment (McConnell, p. 349). Far from replacing current planning techniques and procedures, they were intended to be sup-

plemental to the planning processes already in place within the University and the State Colleges. The specific space needs of individual departments, schools, or campuses would continue to be assessed and developed by campus planners and administrators, with the need for, location, and general configuration of new campuses to be determined at the systemwide level.

Retention of this semi-autonomous system for assessing capital needs was seen as essential for encouraging orderly and intelligent campus expansion. At the time, State policy makers believed the standards should indicate relative need among academic departments, disciplines, and campuses, and that they should be used to estimate the average, but not the absolute, space needs of a unit or a campus. The rationale for standards to be a guide, as opposed to a strict regulatory tool, was also based on the belief that the methods, technologies, and scope of teaching and research were always changing, and that space needs should change with them. In this sense, space planning was seen to be a dynamic process that should continually assess actual program needs. At the same time, the standards were intended to provide State control agencies with a general method for evaluating both the scope of, and the space allocations for, proposed capital projects.

Use of the 1955 Restudy as budgeting standards

Several aspects of the 1955 *Restudy* pointed to the need to retain flexibility in projecting overall capital needs and costs. For instance, when assessing capacity and capital needs at several campuses, aberrations to the standards were openly used, including:

1. The "added allowance of 22.3 net square feet of teaching laboratory space per full-time student at California State Polytechnic College (San Luis Obispo). All standards were increased by 4 percent when applied to that institution to allow for the greater full-time equivalence of its regular full-time enrollment."
2. For the Davis campus of the University of California, a similar additional allocation of "12.1 and 14.6 net square feet per full-time student for teaching laboratories and graduate-student research laboratories." Further, "all standard per-student floor areas for staff facilities (offices in departments of instruction and research, general administrative officers, and staff research) were tripled to allow for the extensive research and service activities of the Experimental Station . . . ."
3. For the Berkeley and Los Angeles campuses of the University, because of "the relationship between over-all per-student space requirements" of these institutions, overall floor area per student was increased by 10 percent (p. 363).

These exceptions point not only to the use of the standards as a general model for budgetary purposes, but also to the State policy of maintaining and encouraging diversity in campus programs. Each project brought to the State might have to compare itself to the standards for a discipline, and for a campus, but it was not to replace the primary criteria: the program and its projected space needs. Another caveat openly noted was that the standards did not take into account the quality of space or the need to replace existing structures. This required individual campus and segmental leaders to assess campus needs and incorporate them into their total capital maintenance and improvement programs.

With the clear exception of classrooms and class laboratories, it was never suggested that the standards should be applied to individual instruction and research projects as a design criteria or as a strict allocation model. For both the University of California and the State Colleges, it was recommended and subsequently implemented that space standards "be used in the planning of all new instructional facilities, [and that] the current procedures used by the University [and the State Colleges] be revised to include the space and utilization standards for classrooms and laboratories which are recommended" (p. 326). This included the utilization formula to assess overall instructional assignable square feet needed within a campus, and the usage of the assignable-square-feet-per-station allocations provided by the standards in the planning of individual instructional rooms (that is, 15 assignable square feet per station for classrooms, and various assignable square feet per station according to discipline for teaching laboratories).

Even with this statement, however, McConnell's Restudy team felt constrained to further emphasize

the need for flexibility in applying both the utilization rates and the space per station allocations:

> The utilization standards should be modified for each institution, particularly the smaller ones, to whatever extent is necessary to permit at least one general classroom in each major size range to be unscheduled each hour, in order to provide reasonable flexibility in the rescheduling of classes after registration, in scheduling of examinations, conferences, etc., and unscheduled uses of classrooms (pp. 309-310).
>
> A standard expressed as an average percentage of utilization cannot be applied inflexibly to all laboratories, because their degree of utilization is determined by different academic factors and will vary from laboratory to laboratory (ibid).
>
> [At] those institutions now offering, or later approved to offer, instructional programs requiring highly specialized facilities there will undoubtedly be areas in which additional facilities are needed despite the fact that over-all capacity of the institution shows no such need. These instances should be considered on their merits and apart from the [space and utilization] figures (p. 356).

Other important aspects of the standards included the encouragement of "each segment in the state to pay particular attention in the planning of new facilities to (1) the appropriate balance in the allocation of floor space among the major uses" (i.e. classrooms, laboratories, libraries, staff offices, based on the academic programs of the early 1950s) (p. 366); and (2) that "effective programming required a moving five-year building program, and continuous review of space standards" (p. 372).

The evolution into design standards

Although the Legislature rejected the *Restudy's* recommendation that no new campuses be established until 1965 -- primarily at the behest of legislators who sought new campuses in their districts -- the new standards formed the basis for all subsequent capital expenditures in higher education. Their success was based partially on the fact that they simply extended existing University of California and State College planning guidelines. (As noted above, use of these standards within the community colleges did not occur until 1965 with the adoption of legislation to provide direct capital assistance to junior college districts.)

In light of the need to pursue a massive building program, both the University of California and the State Colleges relied heavily on these general space standards to design and build numerous academic buildings. Each developed policies that determined when capital planning for specific purposes might deviate from the standards (such as for laboratory space and office allocations). Yet as planners struggled to develop these building programs, they tended to defer to the space allocations provided by the standards, particularly at campuses developing new academic programs. They did so because it was easier to apply the standards strictly than to engage in the often laborious process of tailoring buildings to specific program needs. Applying the formulas rigidly expedited the development of projects and helped to justify them to State-level analysts, but it also created a growing perception that the standards were not general guidelines but inflexible space formulas for use at the design level.

This was particularly true within the State Colleges. When the system came under the Board of Trustees, it inherited the centralized system of space planning maintained by the Department of Education for the system, and initially lacked the planning staff to carefully evaluate individual projects and the programs they were to serve.

As a result, the standards, even with repeated recommendations for review and modification by the new Coordinating Council for Higher Education, became a sort of unwritten law. It was not until the fiscal restraints and political turbulence that occurred during and after 1968, however, that the line between the standards as a planning and budgetary guide, rather than as space and design criteria, become completely blurred -- as will be evident from the following discussion of the reports that emerged after 1955.

1. *The Additional Centers report of 1957*

In 1957, Hubert Semans and Thomas Holy prepared their report, *A Study of the Need for Additional Centers of Public Higher Education in California*, which in essence guided the new campus building program of the late 1950s and the 1960s but made little refer-

ence to the *Restudy* standards. Dominating the study were regional projections of enrollments in the three segments and the projected need for additional campuses based on this enrollment. Semans and Holy derived the capacity of existing campuses by the instructional space and utilization aspects of the 1955 standards, with cost estimates for new construction based on existing five-year building programs and segmentally derived estimates in the final year of the projection.

2. *The Master Plan Technical Committee report of 1961*

In its 1961 report, *Institutional Capacities and Area Needs of California Public Higher Education, 1960-1975*, the Technical Committee on Institutional Capacity and Area Needs of the Master Plan Survey Team linked estimates of campus and segmental capacities to instructional space and utilization standards. At the same time, the committee noted the need for revisions:

> It is the considered judgment of the staff of the Technical Committee on Institutional Capacity and Area Needs that these recommended standards are the best available upon which to base a building program. However, it is the judgment of this Committee that these standards need constant review and possible revision (p. 27-28).

As an example of this need for review, the committee observed:

> At the time of the Restudy in 1955, graduate programs in the state colleges were generally limited to teacher education and to its allied fields. Research was considered [to be] the exclusive function of the University. The recommended standard floor areas [or allocations] proposed for the State Colleges in the Restudy reflect these limitations. Since that time the state colleges have been authorized to extend their graduate programs and currently grant the master's degree in a variety of fields, including the humanities, the biological and physical sciences, mathematics, and the social sciences, as well as occupational fields (Ibid, p. 28).

The committee added that:

> There is danger in the continued pretense of maintaining Restudy standards.... the danger is that this standard may come to have the force of "unwritten law." Hence, a standing committee should be created to review the standards (Ibid. p. 29).

3. *Senate Bill 318 of 1965*

Following the Master Plan recommendation for State construction funds for the junior colleges, Senate Bill 318 initiated direct State support, in conjunction with federal and local monies, for capital projects in the two-year segment. This bill required adoption of elements of the standards for assessing general space needs of this segment: in particular the adoption of instructional space and utilization standards. No other standards were applied, except for those internally applied by local districts and under State Department of Education guidelines, until the 1966 reports, which are discussed in the next three sections.

4. *The Coordinating Council's 1966 report, The Master Plan Five Years Later*

The Coordinating Council's 1966 document, *The Master Plan Five Years Later*, was essentially a status report on the implementation of the 1960 Master Plan. In reference to the Technical Committee's recommendation that standards be modified, the Coordinating Council stated: "Not implemented: A study is currently in progress and will be completed and reported to the Council at its May 1966 meeting." (p. 16) However, the effort to modify and update space allowances was deferred to the next review.

5. *The Coordinating Council's 1966 report on space and utilization standards*

The Coordinating Council's report, *Space and Utilization Standards, California Public Higher Education* (1966), was the first review of space standards since the 1955 *Restudy*. Reflecting the intent of those standards to provide planning criteria for instructional space, virtually the entire study reviewed and modified classroom and class laboratory space allocations and utilization rates:

The standards recommended in this report are the result of an extensive utilization study on campuses in all three segments conducted in 1961. A number of committee meetings of technical experts in the field of utilization from public segments, the Department of Finance, the Legislative Analyst's Office and the State Department of Education were held to consider the findings of the study. Consensus was not obtained on all of the individual components that make up the final formula proposed [for instructional space] in the staff recommendations (p. 9).

Based on existing standards, practices within the segments, advice from architects and planners on per station data, and advice from the Facility Standards Committee, Council staff reviewed classrooms, class laboratories according to upper and lower division, and academic office space allocations. According to the report, a review of research laboratories, music facilities, physical education facilities and libraries "will be conducted at a later date." In the report, the Coordinating council identified four assumptions:

The standards should allow maximum flexibility. They should allow the individual campus planners and architects as much freedom in planning within the parameters of broad standards as is possible. Just as the program budget eliminates the necessity for line item review, so should the formula for determining space allocations eliminate detail such as number of stations, rooms, sizes of service areas and the like (ibid).

The standards, overall, should not be lowered below the Restudy standards [for class and lab utilization] (p. 10).

The standards should be equitable for all segments when concerned with the same levels of instruction and the same subject field areas (ibid).

Space standards should be periodically reviewed to keep up with the changing times (ibid).

Based on these assumptions, the Coordinating Council recommended the following standards:

CLASSROOMS AND TEACHING LABORATORIES:

a. Establishment of lower and upper division components for class laboratory utilization.

b. Use of Weekly Student Contact Hours (WSCH) as the major criteria for assessing utilization, and new utilization numbers proposed and adopted:

Type of Space	Hrs/Week		Stn Occ %	WSCH
Classrooms	34	x	.66	22.4
Class Labs				
LD	25	x	.85	21.3
UD	20	x	.80	16.0

c. Space allocation within the standards, based on the above figures for instructional space, then follows this equation:

$$\frac{\text{ASF/Stn}}{\text{hrs/week x stn occ \%}} \times 100 = \text{ASF/100 WSCH}$$

Since capital outlay must be planned on the basis of space required when students are actually occupying student stations, the weekly student contact hour is the basic unit to be used. However, when enrollment projections are developed, they begin with such data as expected first-time freshmen, transfer students, continuing students, and other similar categories. It is important in converting the projections of full-time students to Student Credit Hours, Full-Time Equivalent Students, or Weekly Student Contact Hours, care is taken to ensure that the conversion is made on the most recent ratios. The Restudy standards were published in terms of square feet per FTE student, based on the ratio in 1953 between the WSCH and the Student Credit Hour (p. 18).

It appears that these ratios of full-time-equivalent students to projected weekly student contact hours were used in large part because real weekly student contact hours were not available on a yearly basis. In subsequent years, the community colleges adopted actual weekly student contact hours, while the University and State University systems retained the 1953 ratios (presumably at their own discretion).

OFFICE SPACE:

a. The California State Colleges and the University of California continue to use the presently existing space standards for office planning and the [institutionally derived] guidelines for office sizes (p. 19).

b. That the standards for college planning of office space and guidelines for internal planning of office space within each college, should be established for the California Junior Colleges . . . [There have been no] standards for projecting the need for office space in the Junior Colleges comparable to the "percentage of the total instructional staff space" recommended in the Restudy and the Master Plan (ibid).

The responsibilities of the Junior Colleges under the Master Plan would indicate a simpler standard for projecting required office space than would be the case in the public four-year segments. One which would appear reasonable would be a standard of assignable square feet for all office space per instructional FTE ("all office space" here includes academic office, other office -- including administrative office -- office service and conference rooms) (p. 20).

[Based on a 1953 Survey of older Junior Colleges], a reasonable standard for long-range planning for California public Junior Colleges [of] 140 ASF per instructional FTE be the standard for determining **overall office space** on a college-wide basis with an adjustment of 20 ASF for "smaller" Junior Colleges of 1,000 students Headcount or less (ibid).

	All JC's ASF/FTE	Small JC's ASF/FTE
Standard (college-wide basis)	140	160
Guidelines for Planning and Design		
ASF/Station	80	80
ASF/Instructional FTE	105	110
ASF/Teaching FTE	63	58

6. *The Coordinating Council's 1966 resolution on space and utilization standards*

Adopted on September 27, 1966, as a result of the previous report, the Council's resolution included the following:

> Whereas, utilization and space standards for the same levels of instruction and subject field areas should be equitable for all segments of public higher education in California and such standards should allow for a maximum of flexibility within the limits of efficient operation; and
>
> Whereas, standards are necessary in the equitable apportionment of State funds for capital outlay purposes and in the development of five-year capital outlay programs in the three segments; and
>
> Whereas, standards should not be applied to new capital outlay projects building by building but on a campus-wide basis; and. . . therefore, be it
>
> Resolved, that the State Board of Education, the State Department of Finance, the Trustees of the California State Colleges and The Regents of the University of California be advised that the utilization and space standards shown [in the 1966 report] be used in programming capital outlay on a campus-wide basis; and be it further
>
> Resolved, that when it is determined that these new standards will have an immediate impact of drastically decreasing or increasing computed capacity at any institution that these standards should be phased in over a period of time . . . and that the Staff of the Coordinating Council for Higher Education, together with the three segments continue to review and conduct a comprehensive re-evaluation of these standards.

7. *The Federal Comprehensive Facilities Grant Program of 1967*

This program initiated the first comprehensive inventory of space in the California Community Col-

leges and State Colleges based on federal space categories (adopted earlier by the University of California) set up by the federal Department of Health, Education, and Welfare. The inventory was completed in 1969.

8. *The Coordinating Council's 1969 report, Meeting the Enrollment Demand for Public Higher Education in California Through 1977*

This report noted two basic options: (1) to establish new campuses; and (2) to increase the capacity of existing institutions. For capital and operating cost reasons, the second option was preferred, with the following caveats:

a. Redirection of students to unfilled campuses; this established the idea that all University and State College campuses would be semi-statewide institutions.

b. The annual growth rate of existing campuses should be increased; however, no preferable growth rate was specified.

c. Year-round operation.

d. Extension of the hours of instruction (an option earlier suggested by the Legislative Analyst's Office):

> It may be reasonable to extend hours of instruction into evening hours and to Saturday morning in an effort to accommodate additional enrollments within the same physical plan. Such action could imply a change in established utilization standards upon which present State capital outlay funds are made available. Current standards call for certain levels of utilization within a five-day week, 8 a.m. - 5 p.m. -- or a 45-hour week. Junior Colleges and some State Colleges now make extensive use of evening hours for instruction. The University of California does only to a limited extent. Saturday classes are not generally the rule.

e. Expansion of institution size wherever the physical site permits.

9. *The California Higher Education Facilities Planning Guide of 1970*

This guide was prepared under a U.S. Office of Education Comprehensive Planning Grant Program grant sponsored by the Coordinating Council for Higher Education and completed by the University of California's Office of the Vice-President, Physical Planning and Construction. The guide attempted to explain major elements of the standards and how, for general planning purposes, they might be applied.

While useful, it was difficult to apply the document widely, since it was heavily oriented toward the University of California system. Also, a section that would have explained how the facilities planning techniques would actually be implemented was never completed. It did, however, affirm a previous precept of the Restudy, that standards should "give an indication of need" at both the systemwide and campus levels, and be part of a comprehensive academic and physical planning effort:

> Space allowances or standards used to measure space adequacy and determine future needs must be valid. [The] cost of new space must be related to appropriate standards and carefully monitored. If any one or more of these controls are not applied, the total effect of the system in the resource allocation process is weakened if not invalidated (p. II.1.1).

10. *First consideration of the Coordinating Council's Facilities Analysis Model of 1970*

Based on its own experience, Council staff was of the opinion that utilization and space standards limited to classrooms and class laboratories were not adequate for determining the total facility needs of higher education campuses. An approach was required that could give consideration to other factors such as an emphasis on the level of instruction, patterns of attendance, geographic location, site limitation, environment, academic program, scheduling, and campus maturity; and could consider these factors singly or in combinations with regard to both capital and operating costs. In February, 1970, with advice from the ad hoc committee, the Council contracted with Mathematica, Inc. of Princeton, New Jersey, to develop a Facilities Analysis Model (FAM) to consider these other factors and to determine the utilization rate associated with the minimum total cost (capital cost plus operational cost) of providing an educational program.

11. *Assembly Concurrent Resolution 151 of 1970*

Following the defeat of Proposition 3 -- a $200 million bond issue -- by the voters in 1968, the Legislative Analyst and the Department of Finance recommended substantial increases in classroom utilization standards, which the Legislature implemented through Assembly Concurrent Resolution 151. This resolution extended utilization rates for classroom space to a 70 hour week: 8 a.m. to 10 p.m. five-days a week, and thereby dramatically increased the theoretical capacity of existing institutions (by 56 percent). The resolution also directed the Coordinating Council to evaluate utilization rates and practices at the California State Colleges' Long Beach and Fullerton campuses. For its part, the Coordinating Council opposed the legislation and continued to argue that the 1966 utilization standards should be maintained until further review and completion of the Facilities Analysis Model.

12. *The Coordinating Council's 1971 report, Inventory and Utilization Study for Public Higher Education, Fall 1969*

This report concluded the Council's inventory and utilization study and also constituted a response to Assembly Concurrent Resolution 151. It contained a number of findings and conclusions:

1. Work by the U.S. Department of Health, Education, and Welfare has produced greater uniformity in defining higher education space types.
2. California's utilization standards are 80 percent more restrictive than the average for eight other states.
3. Utilization reports for classrooms and class laboratories for other than regularly scheduled instructional activities are unavailable, and should be produced.
4. A gradual extension of the operating schedule into the evening hours will likely be the most economical pattern to follow.
5. Low utilization at some campuses is due to traditional patterns of scheduling.
6. Existing space standards for classrooms and undergraduate class laboratories need to be revised and space standards developed for class laboratories in those subject fields presently without standards.
7. A single utilization standard should not be applied uniformly to all campuses and colleges. Therefore, the facilities analysis model should be used to determine the best utilization pattern for individual campuses in order to produce the least total cost of operation.

13. *The Coordinating Council's 1973 report, A Facilities Analysis Model for Space Planning and Cost Simulation*

In this report, the Council noted numerous problems with the development of the Facilities Analysis Model (FAM) because of the lack of proper data at the campus and segmental levels, and poor access to a powerful enough computer system at the Coordinating Council. The Council concluded that FAM, in essence, was unusable.

14. *The Council's 1973 report, Criteria for Selecting Campus Size*

In this report, the Coordinating Council responded to both Assembly Concurrent Resolution 151 of 1970 and Assembly Concurrent Resolution 166 of 1971, which directed the Council to review possible standards for setting current and projected campus enrollment capacity. In it, the Council offered several criticisms of the previous legislative action:

> After a $200-million capital outlay bond issue for higher education had been rejected by the voters in 1969, the Legislative Analyst proposed and the Legislature approved a major increase in facilities utilization. A fundamental objective of the new standards was to permit a substantial increase in student enrollments generally throughout public higher education without significant outlays in capital investment. The effect, however, was pressure to increase enrollments of campuses where student demand was greatest rather than generally throughout the public system.
>
> The natural effect of the 1970 utilization standards is to bring a revision in maximum enrollment in order to achieve a standard of facilities utilization without giving attention to

many other factors that should be considered before increasing enrollments (p. iii-viii).

15. *Supplemental Language to the 1973-74 Budget Act*

In 1973, the Legislative Analyst insisted that utilization standards for Class Laboratories, like classrooms under Assembly Concurrent Resolution 151, should also be increased to a 70-hour week. Until the Coordinating Council established new standards under this 70-hour week, the Analyst recommended and the Legislature directed that the University of California, the State University, and the Community Colleges "base their building space needs in class-laboratories on 110 percent (27.5 hours/week lower division, 22.0 hours/week upper division) of current 8 a.m. to 5 p.m. utilization standards." The Coordinating Council, which was subsequently replaced by the California Postsecondary Education Commission, did not follow with a study but continued to view the new 70-hour week as unreasonable.

With the 1973 Supplemental Budget Language, the 18-year discussion of space and utilization standards was adjourned for a decade and a half. Over that period from 1955 to 1973, however, many changes were made, particularly in classroom and teaching laboratory utilization, as indicated in Display 2 below.

These studies and legislative actions form the basis for today's interpretation and application of the *Restudy* standards. No further studies were completed until 1986. The failure to review the needs of individual disciplines (recommended by the Master Plan Technical Committee in 1961 and subsequent groups), meant that when new disciplines were created, such as computer science, the segments simply negotiated with the Department of Finance to use a hybrid of two existing disciplines rather than assess real space needs. In addition, a period of retrenchment set in and interest in updating the space standards diminished. There were a number of reasons for this waning interest: a political backlash against higher education institutions in general; restraints on State funding; and enrollment projections that showed a leveling of student demand. At the same time, the standards slowly evolved into a system where they were considered less as budget-

DISPLAY 2 Utilization Guidelines for Instructional Space, 1955-1973

	Classrooms					Teaching Laboratories				
Report or Legislation	Weekly Room Hours		Station Occupancy Percentage		Weekly Station Hours	Weekly Room Hours		Station Occupancy Percentage		Weekly Station Hours
1955 Restudy	36	x	67	=	24.0[1]	24.0	x	80	=	19.2[1]
1960 Master Plan	30	x	60	=	18.0[1]	20.0	x	80	=	16.0[1]
1966 CCHE	34	x	66	=	22.4[1]	25.0 LD	x	85	=	21.3[1]
						20.0 UD	x	80	=	16.0[1]
1970 ACR 151	53	x	66	=	35.0[2]					
1973 Budget Act						27.5 LD	x	85	=	23.4[1]
						22.0 UD	x	80	=	17.6[1]

1. Based on a 45-hr week (8 am to 5 pm, 5 days).
2. Based on a 70-hr week (8 am to 10 pm, 5 days).

Source: McConnell, 1955; Master Plan Survey Team, 1960; CCHE, 1966; CPEC, 1986.

ary guidelines and increasingly as a regulatory tool to deny individual capital projects.

Origins of the current study

As noted above, there was very little interest in revising space and utilization standards between 1973 and the early 1980s. Beginning in the 1984-85 fiscal year, however, the Legislature approved large appropriations to accommodate new growth, increasing annually to about $550 million for each of the past two years. To support these appropriations, the voters approved two bond issues in 1986 and 1988 that totaled $1 billion -- one for $400 million in 1986, and the other for $600 million in 1988.

The increase in capital appropriations brought a renewed interest in space standards, exemplified by the approval of two items of supplemental language to the 1985 Budget Act. The first of these required the Commission to examine space standards for self-instructional computer laboratories -- a directive that led to the development of the first official standards for those spaces, which were specified in the Commission's 1985 report, *Self-Instructional Computer Laboratories in California's Public Universities*. The second item of supplemental language required the Commission to "study the current space and utilization standards for undergraduate class and graduate laboratories and faculty research/office space in public higher education" (1985 Budget Act, Item 6420-001-001, Number 4). The principal impetus behind this language was a series of University of California requests for research laboratory space that exceeded the existing 1955 *Restudy* allocation standards.

In February 1986, the Commission released its report, *Time and Territory: A Preliminary Exploration of Space and Utilization Guidelines in Engineering and the Natural Sciences*, in which it concluded that considerable evidence existed for alterations in the standards, but that a final determination of necessary changes should await a more comprehensive analysis of the subject. Specifically, the Commission recommended that utilization standards for classrooms be relaxed on an interim basis, since California's standards were extremely restrictive in comparison to national norms. If adopted, such a recommendation would have permitted the construction of a greater amount of classroom space than under the existing standards. Similar recommendations were offered for research laboratories in various scientific fields.

The Commission emphasized that the results of this first study were preliminary, and that its recommendations should be adopted only until a more extensive study could be conducted. It did so because much of the national data contained in the report was not possible to confirm in the time span allotted for the preliminary inquiry. The Legislature examined the report carefully, but chose not to adopt the recommendations until the more comprehensive study had been completed. To that end, it appropriated $300,000 in the 1986-87 Budget Act -- financed in part by the segments and in part by the State. Because the State's share was vetoed by the Governor, however, the study was delayed for a year.

In 1987, the Legislature again appropriated $300,000 to the Commission, but with the funding responsibility to be shared equally by each of the public segments from their 1987-88 appropriations. The Commission subsequently approved a prospectus for the study based on its April 1986 report, *Time and Territory: Phase II* (reproduced in this report as Appendix A). That prospectus anticipated the retention of a consultant to perform three basic tasks:

1. Conduct a comprehensive national survey to compare California's space standards with those in use in other states;

2. Analyze inventories and utilization studies produced by California institutions to determine their accuracy and intersegmental consistency; and

3. Through extensive consultation with faculty and other campus officials, determine whether changes in teaching and research techniques required alterations in the standards currently in use.

The study was specifically limited to four types of space -- classrooms, teaching laboratories, research laboratories, and faculty offices -- space that represents about 50 to 60 percent of all nonresidential facilities on most campuses. This limitation was chosen in part because classrooms and laboratories account for almost all of the full-time-equivalent en-

rollment generated, because standards for these types of spaces provide strong indications of need for other types of spaces such as libraries and administrative areas, and also because of the clear need to render the study manageable. To have extended the study to auxiliary areas would have delayed the final report for at least another year at a time when the need to develop new standards for academic spaces was clearly evident. Since the types of spaces under consideration can be analyzed independent of all other campus facilities, such a delay was considered to be unnecessary.

3 *The MGT Study*

Selection of a consultant

For the development of *Time and Territory*, the Commission used a Technical Advisory Committee consisting of representatives from the Department of Finance, the Office of the Legislative Analyst, and each of the three public segments. With the appropriation of funds to conduct the more extensive analysis, this committee was reconstituted in July 1987 as the Advisory Committee on Space and Utilization Standards, with members expected to provide data to Commission staff and the consultants, offer advice on various aspects of the study, and ultimately consult with the Commission on changes in the existing standards.

The Advisory Committee's first task was to review a Request for Proposals that was developed by Commission staff in order to select a consultant. All members of the committee indicated their satisfaction with the request for proposals, which was then distributed. The Commission received six specific proposals that were reviewed in September and October by an internal Commission staff committee. Following this review, the Commission selected MGT Consultants, Inc., in early November 1987 to undertake Phase One of the study.

Phase One: the national survey

The Advisory Committee convened for the first time in November 1987 to meet the consultants and review and comment on the proposed workplan for the national survey of space standards. That plan called for MGT to contact with officials in all 50 states by telephone and then select for more detailed investigation those states that employed standards in the development of capital projects. MGT's initial contacts produced a list of 18 states and one Canadian province (Ontario) where space standards were in use, and plans were formulated to make visits to each. In addition, four private universities (Harvard, Yale, Massachusetts Institute of Technology, and Brigham Young) were also selected. In subsequent months, the committee met approximately every six weeks to receive progress reports, and several members of the committee traveled with the consultants for some of the on-site visits, which were completed by Spring 1988.

Within a relatively short time, it became apparent that reconciling the space standards used in other states to those in California would be an inordinately complex task The consultants found that most states used unique methodologies for counting enrollments, with some using headcount enrollments, others using full time equivalents -- and often computing full-time-equivalent numbers in different ways -- some applying standards only to daytime hours while others included evenings, and one state applying the standards only to the most active time block (day or evening). Some states used fall term enrollments, others used annual averages, and one state (Oklahoma) added enrollments from all terms together, thus creating the false impression that their utilization standards were twice as restrictive as they actually were. The result was that states using what appear to be identical classroom or teaching laboratory standards may in fact have very different requirements. For research laboratories, some states assigned square feet based only on faculty members and graduate students, while others included graduate research assistants, postdoctoral fellows, technicians, or other personnel. Different states also defined faculty members in different ways and used different budgeting methods that needed to be reconciled. For faculty offices, no two states used the same procedures, and few states used similar methods for computing support space.

To resolve these problems, the consultants employed "normalization" techniques whereby various inconsistencies among the surveyed states could be reconciled. To do so, they created "prototype" systems that closely resembled the California segments, then adjusted each of the surveyed states for two categories of variable: (1) differences in enrollment counting procedures; and (2) differences in the length of the school day to which the standards ap-

ply. These adjustments produced an approximate comparability whereby California's classroom, teaching laboratory, research laboratory, and faculty office standards could be compared to national norms, although a modest margin of error -- probably about 5 percent -- should be applied to the results. The specifics of MGT's analytical techniques, all of which were fully explained to and discussed by the advisory committee, are contained in their final report on the national survey, *Survey of Space and Utilization Guidelines and Standards in the Fifty States* (1989a). The executive summary of that report is shown in Appendix B, and generally concludes that California's existing space and utilization standards are the most restrictive in the nation in the sense that they provide fewer assignable square feet of space than other states in virtually every space category. California's rank in each space category is shown in Display 3 below. The specific data from the national survey is discussed in greater detail in Parts Four through Seven.

According to the original time schedule, the national survey should have been completed by December 1988, but a number of circumstances prompted the consultants, with the concurrence of the advisory committee, to extend that deadline. First and foremost was the fact that the process of selecting MGT had delayed the study's start for about two months. Second, the subject matter was more complex than originally thought and produced a need to confirm analytical results with officials in the states that had provided data, which delayed completion of MGT's final report for several months. Third, with the contract extension into Spring 1989, and the fact that there had never been an intention to recommend changes in the standards until the entire project was completed, no need was seen to rush the national survey into final form. Accordingly, the two volumes (approximately 500 pages) of MGT's final report were not formally released until April 1989. A further update of the data was completed on October 18, 1989.

DISPLAY 3 *Rank Comparison of Current Space Standards in California and Surveyed States for Classrooms, Teaching Laboratories, Research Laboratories, and Faculty Offices*

Type of Space	Lower Division	Upper Division	Graduate I	Graduate II	General Assignment Space
Classrooms					
UC	16/16	16/16	16/16	16/16	N/A
CSU	16/16	16/16	16/16	N/A	N/A
CCC	11/11	N/A	N/A	N/A	N/A
Teaching Laboratories					
UC	14/15	11/15	N/A	N/A	N/A
CSU	14/15	11/15	10/14	N/A	N/A
CCC	3/9	N/A	N/A	N/A	N/A
Research Laboratories					
UC					9/11
Faculty Offices					
UC					13/17
CSU					16/17
CCC					11/11

NOTE: This display indicates, for example, that California ranked 13th out of 17 states examined (including California) in the MGT national survey. If California ranked 13th out of 17, it means that 12 states provided for a greater number of square feet than California, and 4 states provided fewer square feet. Where the rank shows, for example, "Classrooms, CSU, 16/16," it means that every surveyed state used space standards that provided for more square feet than California in that category.

Source: MGT, 1989a.

Phases Two and Three: the inventory analysis and focus group discussions

In the Spring of 1988, it became necessary to select a consultant for the last two phases of the project -- the examination of inventories and utilization studies in the California segments, and the analysis of how curricular changes over the past 20 to 30 years had affected space requirements After consultation with the Advisory Committee, Commission staff decided that the most prudent course of action was to extend the contract with MGT without engaging in another competitive bidding process. This was done for several reasons First, competitive bid processes are time consuming, and the project schedule was already very constricted. Second, the advisory committee was sufficiently impressed with MGT's work on the national survey that it doubted that any other potential contractor could match MGT's demonstrated expertise. Third, because of the information MGT had already developed, it was clear that no other potential consultant could provide as comprehensive a final product within the limited resources available. Finally, an extension of MGT's contract permitted all involved with the project to tailor the second phase work precisely, which could not be done if contractors were invited to bid on what would have to be a predetermined work plan. For all of these reasons, on May 2, 1988, the Commission approved extending MGT's original contract from November 30, 1988 to March 31, 1989.

In the summer of 1988, MGT developed a detailed work plan for visits to campuses in all three segments of California public higher education to determine the accuracy of facilities inventories as well as the availability of utilization studies. These visits were conducted in September, October, and November, and included surveys of four University of California campuses, nine California State University campuses, and 16 community college districts, for a total of 29 visits. In addition, plans were prepared to conduct focus group discussions with faculty and administrators to determine how changes in academic and vocational disciplines had affected the need for classroom, laboratory, and office space in each of the segments.

The focus-group sessions constituted the major challenge of the remainder of the consultant's study, since it became apparent almost immediately that most of the important questions surrounding the space standards project could only be answered by subjective judgments. The national survey provided one of those judgments, but the informed opinions of faculty members who actually worked in the classrooms, offices, and laboratories under consideration in the study were necessary for the other. While still short of a pure analytical determination, the combination of survey and interview information provided both the Commission and the advisory committee with as clear a view of the problem and its potential solutions as any effort made in California or nationally for several decades

Because the focus groups were intended to develop information on disciplinary changes, an immediate difficulty was to determine which disciplines should be surveyed from among the hundreds available. This determination fell largely to the segmental representatives on the advisory committee, who were asked to develop disciplinary taxonomies in a sufficiently compact form to permit the consultants to function effectively within limited resources. Finally, 24 disciplines were selected for examination, with the University receiving the most groups -- 12 -- primarily because of its diversity of disciplines and the need to examine research laboratory changes in depth. The State University required seven -- two more groups than the community colleges, which had five, due to its greater array of disciplines.

The major points from MGT's final report are summarized in Display 4 on pages 32-34.

DISPLAY 4 Summary of MGT Conclusions

INVENTORY AND UTILIZATION DATA

Conclusions

1. Although some deviations were noted, the inventories maintained by the public segments are substantially accurate. Some differences between room category and room use were observed, but the inventories were over 90 percent accurate in each of the three segments.
2. The actual number of stations in classrooms and laboratories exceeded inventory records by a small margin, except in the State University where the number of actual stations exceeded the inventory count by 22 percent.
3. There were no significant differences between systemwide and local inventory records in the University of California or the California Community Colleges. Substantial differences were found, however, in the State University. The State University has indicated that its inventory records are being revised substantially and should be accurate in the future.
4. The California State University is the only segment that maintains centralized classroom and teaching laboratory utilization data, although utilization studies are regularly conducted on at least several University of California campuses. MGT found no examples of complete space use studies in the Community Colleges.
5. Although the proportion of smaller or larger rooms on a campus does not appear to affect room or station utilization, the match between course and room size does. Specifically, MGT noted: "The lack of correlation between room and course size may preclude an institution from meeting state standards. Alternatives to rectify this situation may require an institution to make decisions which are not program or cost effective in order to meet state standards" (MGT, 1989c, p. 31).
6. In some cases, California's classroom utilization standards cannot be met. MGT observed:

   Based on information gathered for this study in California and other states, we must conclude that it is typical to experience at least 4 hours per 14 hour day (8 00 a m. to 10:00 p.m.) during which utilization falls significantly below standards In a few cases, logistically constrained, non- or low-residential campuses for example, institutions may only be able to achieve utilization standards during morning or early afternoon hours, falling significantly below standards more than 4 hours per day.

   Several examples of failed efforts to improve utilization during off-peak hours were observed during our review. Programs included offering key courses/popular instructors during off-peak times, appealing to specific prospective student populations available during these hours (e.g., retired individuals), and offering complete degree or certificate programs during off-peak hours.

Recommendations

1. No changes in space inventory records are recommended.
2. The Board of Governors of the California Community Colleges should encourage local districts to use existing data to develop regular studies of the utilization of classrooms and laboratories.
3. University of California campuses should expand their classroom utilization studies to include teaching laboratories, with the submission of regular periodic reports for analysis.
4. All segments should analyze the degree of fit between room size and course size to identify the impact of mismatches on space utilization and the degree to which the mismatches prohibit achieving State standards.

DISPLAY 4, continued

5. The Advisory Committee on Space and Utilization Standards should carefully assess the current 70 hour-per-week room availability and the 53 hour-per-week and 67 percent-station-use assumptions currently used as a basis for determining classroom needs.

CHANGES IN ACADEMIC DISCIPLINES

Findings and Conclusions

All Space Categories

1. The existence of readily available computer capability has affected space needs in all categories.
2. Handicap access and related student station requirements have had a modest impact on space not contemplated in the (existing) standards.
3. The current standards do not include a method for projecting student study space outside of the library and the self-paced instruction.

Storage and Support Space

4. Technologically advanced equipment usually supplements rather than replaces old equipment due to instructor preference, inventory system requirements, or simply because the old equipment performs some operations better than the new. Therefore, storage space needs have increased with new technology even though equipment might be smaller.
5. Operating budget allowances and lower prices encourage acquiring state-of-the-art equipment but required set-up and storage space constraints limit actual acquisitions.
6. The number of courses taught in alternating semesters has increased, increasing the storage space needed, since existing space must now support more courses.
7. The increased use of computers has created greater needs for support staff and shop space.
8. The increased use of instructional aids and a more "hands-on" approach has increased the demand for both storage and shop space.

Classrooms

9. An increased emphasis on research in the State University has created pressure to adjust teaching load requirements or to teach larger classes for more concentrated teaching unit credits, thereby generating "released time" for research. A shortage of larger classrooms and an inability to justify new space based on current standards produces a situation where space considerations can drive program decisions.
10. Substantial increases in the use of film, video tape, in-class demonstrations, and interactive computer instruction have increased the need for media support space.
11. Interactive use of lap-top or built-in computers will increase space needs in the future.
12. There has been an increased emphasis on teaching application skills as opposed to theory. This has served to increase emphasis on laboratory work and to mix lecture and laboratory instruction, thereby blurring the distinction between the two.

Teaching Laboratories

13. The increased emphasis on application rather than theory has resulted in more experiments conducted and more scheduled and self-instructional laboratory time being required than in the past. This results in students requiring more station hours.
14. Work-in-progress, particularly in the arts and sciences at the upper-division level, is larger

DISPLAY 4, continued

and more complex, requiring more space than in the past.

15. Specialized equipment now measures results at narrower tolerances. Some of this equipment requires dedicated specialized laboratory space not needed in the past.

16. Health and safety requirements have increased space needs for storing, handling, and disposing of hazardous materials.

Research Laboratories

17. Research team composition varies widely among and within disciplines, making a "research unit" concept for space allocation problematic.

18. Master plan recognition of the research function for the State University indicates a need for more than an informal research space standard.

19. At both the University of California and the California State University, undergraduate involvement in research is becoming more common. Current standards only provide space for graduate level research students and staff.

20. Space allowances for computer work stations capable of simulation and modeling, i.e., CAD/CAM, are not recognized in the current research laboratory standards.

21. Recognition of only State-funded staff excludes a growing number of postdoctoral fellows

Academic Offices

22. Most faculty have personal computers In the future, these are likely to be tied to central information systems for record keeping, word processing, demonstration, instruction, etc. A personal computer/work station, printer, and other peripheral equipment and supplies requires more office space than a typewriter.

23. The State University Board of Trustees' policy of providing single-faculty offices for full-time professors will raise the issue of how to accommodate existing space in estimating future needs.

24. The standards do not provide space for emeriti and visiting faculty. The importance of these individuals and their contribution to the missions of colleges and universities is therefore not recognized in the current standards.

4 Classrooms

AMONG the four types of space and utilization standards under consideration in this project (those for faculty offices, classrooms, teaching laboratories, and research laboratories), classroom standards have the longest history. First considered by the Strayer Committee in 1947, only utilization standards were proposed, with the thinking at that time reflected accurately in its 1948 report

> It is the consensus of many of the foremost leaders in education that a school week in excess of forty-five hours is unsatisfactory. Particularly is this true when many of the students attending our schools have to commute daily from points as far distant as from 30 to 50 miles. Even should the number so affected be relatively low, their existence so complicates the entire school schedule as to make the practice of extending the school week by 10, 20, or 30 hours a very questionable one (Strayer, 1948, pp. 84-85).

Based on this principle, the Strayer Committee recommended that classrooms should be in use for 65 percent of the hours available between 8 a.m. and 5 p.m., Monday through Friday, or a total of 29 hours per week. No recommendations were forthcoming concerning a station occupancy percentage or the number of assignable square feet that should be allocated per student station.

In the early 1950s, the perception of reasonable utilization changed, with the *Restudy* team concluding that more hours should be used, and that a guideline for station utilization and space per station should also be adopted (McConnell, 1955). They recommended an increase in room usage from 29 to 36 hours (80 percent of the available 45 hours in a daytime week), specified that two-thirds of the seats should be occupied when each classroom was in use, and added allowances of assignable square feet per full-time-equivalent student that varied by discipline and by level of instruction. These standards are shown in Display 5 below.

In 1959, the Master Plan Survey team looked at classroom space and utilization standards, but not in any appreciable depth. Relatively well satisfied

DISPLAY 5 Space and Utilization Standards for Classrooms Recommended by the McConnell Committee in the 1955 Restudy of the Needs of California in Higher Education

	Net Square Feet per Total Full-Time-Equivalent Student		
Discipline	Lower Division	Upper Division	Graduate
Agriculture	7.1	7.2	1.7
Arts	6.5	6.2	5.3
Engineering	5.4	7.5	2.3
Languages and Literature	11.9	9.5	9.5
Mathematics	9.6	9.5	9.5
Miscellaneous Professions[1]	8.7	8.9	8.0
Biological Sciences	6.6	7.2	1.8
Physical Sciences	8.0	8.0	1.8
Social Sciences	9.5	9.2	8.4

1. Education, journalism, law, librarianship, and social welfare.

Source: McConnell, 1955

with the work of the *Restudy* team, they recommended no changes in the space standards but concluded that the utilization standards of 36 hours per week with 67 percent station occupancy were too stringent. They urged a relaxation to 30 hours with 60 percent station occupancy -- a 25 percent reduction from the earlier guideline.

In 1966, the Coordinating Council for Higher Education introduced several major innovations. Rather than computing space needs on the basis of net square feet per full-time-equivalent student, the Council opted for a measure of assignable square feet per station. It also rejected full-time-equivalent students as a measuring unit in favor of weekly student contact hours, and then developed a formula that integrated both the space and the utilization factors into a single number that determined assignable square feet per weekly student contact hours. That formula was adopted in California and many other states, where it is still widely employed today.

The Council's determination of space needs produced a 15 assignable-square-feet per-student-station standard, and it also recommended a change in the utilization standard to 34 weekly room hours with a 66 percent station occupancy percentage. This produced a weekly station hour expectation that every seat in every classroom should be occupied for 22.4 hours per week, which compared to the *Restudy* figure of 24.0 and the Master Plan Survey Team recommendation of 18.0. For the first time, the standards were applied to the California Community Colleges as well. These recommendations became the basis for higher education planning for the next several years, until various circumstances prompted the Legislature to alter the standards again.

For various reasons, including the continuing influx of students and the defeat in 1968 of Proposition 3 -- the higher education bond issue -- the Legislature sought to find ways to increase campus capacities without building additional facilities. Attention focused on utilization, and after several years of debate on the subject, the Legislature approved Assembly Concurrent Resolution 151 (Mulford), which extended the existing Coordinating Council standard into the evening hours. This action assumed that if classrooms could be used 75 percent of the time during the day between 8 a.m. and 5 p.m., with a 66 percent rate of station occupancy, they could be used at exactly the same rate during the evening hours between 5 p.m. and 10 p.m. The net effect of the change was to raise the weekly station hour standard from 22.4 hours per week to 35, a lecture capacity increase of 56.3 percent. Since lecture capacity is responsible for the generation of about two-thirds of all full-time-equivalent enrollment on most campuses, such an increase dramatically expanded the theoretical full-time-equivalent capacity of the campuses in all three segments. What it did to the actual capacity, however, was uncertain.

Assembly Concurrent Resolution 151 did not pass without controversy. The Coordinating Council criticized the decision as overly simplistic, noting that the change did not take a number of other factors into account. Specifically, the Council stated in a 1971 report that consideration should have been given "to other factors such as emphasis on level of instruction, patterns of attendance, geographic location, site limitation, environment, academic program, scheduling, and campus maturity" (p. iv). At a Coordinating Council meeting in which the above report was discussed, University of California President Charles Hitch was particularly outspoken on the subject of the 35-weekly-station-hour standard:

> The State administration and Legislature are understandably seeking ways to accommodate students with a minimum of capital outlay, but I do not believe their basic interest would be served by the adoption of extreme utilization standards which apply to one limited facet of the educational process, that of scheduled organized classes. We should remember that capital outlay budgeting requires several years of lead time. The full consequences of the adoption of unreasonable standards would be delayed, and no quick correction would be possible. I believe the Council should advise the Legislature that its proposed classroom standard is not sound for planning purposes . . . and that the achievement of the higher utilization standards proposed for our student population would have highly deleterious effects both on operating costs and on the educational process (Hitch, 1971).

One of the provisions of Assembly Concurrent Resolution 151 was a requirement that the Coordinating Council "conduct a comprehensive evaluation of these new standards . . . and to report their findings

and recommendations to the Legislature by January 1971." This report was submitted, but it was so controversial that the final recommendation tended toward equivocation (p. XI-2):

> It is recommended that the segments move toward a weekly room hour standard of 53 hours based upon extended day operations with 66 percent station occupancy for both existing and new classroom facilities **when feasible and economical** (emphasis added).

Along with this recommendation, the Council called for further revisions in the standards, to be submitted by December 1971, and creation of a Facilities Analysis Model that would ultimately become the basis for determining what space and utilization standards should be and how facilities should be managed. The requirements of Assembly Concurrent Resolution 151 were consequently regarded by most participants in the process to be temporary in nature, pending the development of further information.

In 1971, the Council retained a consultant, Mathematica, Inc. of Princeton, New Jersey, to design the Facilities Analysis Model. Unfortunately, that effort produced no positive results, as the model submitted by the consultant was so complex and required such large amounts of data and computer capacity that it was soon abandoned as unworkable. Shortly thereafter, the entire project to review space and utilization standards was also abandoned, for reasons noted in Part One.

Classroom utilization trends since ACR 151

In its 1971 report, the Coordinating Council presented utilization data for the Fall 1969 term, including the classroom utilization data shown in Display 6 below The display indicates that station utilization rates (weekly station hours) varied considerably among the segments, with the California State Colleges showing an 8 a.m. to 10 p.m. rate of 28.9 hours (29.0 percent higher than the then existing standard of 22.4), and the University of California reporting 17.5 hours (21.9 percent below the standard). Of note then as now, the evening usage also varied considerably, with the State and community colleges both benefiting from the fact that they operated large evening programs. The University of California, which has traditionally operated only during the day - University Extension occupies large areas of space in the evenings,

DISPLAY 6 Classroom Utilization Data Developed by the Coordinating Council for Higher Education (CCHE), Fall 1969

Segment/Item	Weely Room Hours		Station Occupancy		Station Utilization	
	8am-5pm	8am-10pm	8am-5pm	8am-10pm	8am-5pm	8am-10pm
California State Colleges	31.6	39.1	76%	74%	24.0	28.9
University of California	27.5	29.2	62%	60%	17.0	17.5
California Community Colleges	24.9	32.8	74%	73%	18.4	23.9
CCHE Standard (1966) (8am - 5pm)	34		66%		22.4	
Legislative Standard (1970) (8am - 10pm)		53		66%		35.0

Source: CCHE 1969, 1971.

but such use does not count toward satisfaction of the utilization standard -- added only 0.5 hours to their total classroom utilization when the evening was considered, where the State University added 4.9 hours and the community colleges 5.5.

There can be little question that the Legislature's intent was to improve classroom utilization considerably, but recent data indicate that the degree of improvement has been less than was originally anticipated. Both the quality and the quantity of utilization data vary considerably among the segments, with the most comprehensive information coming from the State University, and the least from the community colleges. In the State University, the Fall 1987 utilization study shows classroom utilization to be 31.3 weekly station hours -- an increase of 8.3 percent from 1969 and the highest level ever recorded for the system. Data from other years indicate the following: 1973, 27.9 weekly station hours; 1976, 28.1; 1981, 29.1; 1983, 29.7; and 1984, 29.5.

Recent data from the University of California also indicate improvement from pre-1970 levels. Although statewide data are not compiled systematically, the University did conduct a special study of its campuses for this report, the data from which are shown in Display 7 on the opposite page. Those data show weekly station hour utilization ranging from 24.1 to 33.8 hours per week and compliance with the 35-hour standard ranging from 68.9 to 96.5 percent.

No utilization data are available from the California Community Colleges.

Another data array contained in the Coordinating Council report concerned inventories. Displays 8 through 12 on pages 40-44 show the mix of various kinds of nonresidential spaces for the Fall 1969 or 1970 term and also for more recent years. Each of these displays indicates a contraction in the share classrooms occupy of the total nonresidential assignable square feet in each of the segments. Displays 8 and 9 show how the share of classrooms at the University of California has declined from 5 to 4 percent between 1969 and 1988. Displays 10 and 11 show a somewhat greater reduction in the classroom share in the State University -- from 12.1 percent in Fall 1970 to 8.3 percent in Fall 1987. They also indicate that while the State University has added 6.3 million nonresidential assignable square feet of space in the past 18 years, only 62,000 assignable square feet in lecture facilities have been constructed. Had the classroom share remained unchanged from its 1970 level of 12.1 percent, the total would have been 763,000 assignable square feet. Admittedly, it is very unlikely that an additional 700,000 assignable square feet of classroom space would have been built had the utilization standard not been changed from its pre-1970 level, since other space types, especially libraries and "general use" space -- the latter defined by the State University as "assembly, exhibition, merchandising, recreation, and lounge spaces" -- have occupied an increasing share of its total physical plant since 1970. Nevertheless, there can be little doubt that the standard of Assembly Concurrent Resolution 151 did have the effect of severely restricting the State University's ability to build classroom facilities.

In the California Community Colleges, inventory data from the late 1960s and early 1970s were lost in the 1982 fire that destroyed the Chancellor's Office, but the Coordinating Council reported in 1971 that community college classrooms comprised 16 percent of total nonresidential assignable square feet in Fall 1969. The Fall 1988 inventory indicates that the classroom percentage has declined to 13.7 percent, as shown in Display 12.

Because the data on classroom utilization are not of a consistent quantity or quality across the segments, it is difficult to draw definitive conclusions about the effects of ACR 151. MGT examined this problem in its final report with some care, however, and drew a number of conclusions, as noted in Part Two. Among the most important was that it is necessary to understand the complexity of the academic enterprise before a reasonable utilization standard can be developed. Many factors impact the ability of any campus to achieve the existing utilization standard of 35 hours per station, among them the concordance or "fit" between room size and course size, segmental mission, and the ability to offer classes at unpopular hours while maintaining a sufficiently high class size to warrant offering the class at all; clearly, unduly small classes have a deleterious effect on the support budget. To that, it can be added that the extent to which a campus is over or underenrolled in comparison to the size of its physical plant can have a dramatic effect on its ability to achieve any given utilization level, as will be discussed further in the next section.

DISPLAY 7 Classroom Utilization by Room Size at the Davis and Santa Cruz Campuses of the University of California, and Total Utilization for All General Campuses, Fall 1988

Davis

Room Size	Number of Rooms	Total Seats	Weekly Room Hours	Station Occupancy Percentage	Weekly Station Hours	Percent of Standard
Below 40	49	1,419	43	68.0%	29	83.5%
40 - 99	45	2,568	43	65.0	28	79.9
100 - 199	10	1,354	42	83.0	35	99.6
200 - 399	5	1,242	41	79.0	32	92.5
400 - 599	1	418	44	90.0	40	113.1
Total Campus	*110*	*7,001*	*43.1*	*72.0%*	*31*	*88.7%*

Santa Cruz

Room Size	Number of Rooms	Total Seats	Weekly Room Hours	Station Occupancy Percentage	Weekly Station Hours	Percent of Standard
Below 25	25	468	46.1	88.9%	41.0	117.1%
25 - 49	19	645	49.7	66.0	32.8	93.7
50 - 89	6	390	51.1	58.6	29.9	85.6
90 - 149	5	559	49.8	58.7	29.2	83.5
150 - 200	4	683	43.2	63.0	27.2	77.8
200 - 500	2	707	47.1	59.3	27.9	79.8
Total Campus	*61*	*3,452*	*47.9*	*64.6%*	*30.9*	*88.4%*

General Campuses

Campus	Weekly Room Hours	Percent Station Occupancy	Weekly Station Hours	Percent of Standard
Berkeley	34.0	73.6%	25.0	71.5%
Davis	43.1	72.0	31.0	88.7
Irvine	40.8	82.8	33.8	96.5
Los Angeles	36.3	67.5	24.5	70.0
Riverside	39.1	61.5	24.1	68.9
San Diego	46.9	71.9	33.7	96.3
Santa Barbara	41.5	61.5	25.5	72.9
Santa Cruz	47.9	64.6	30.9	88.4

Source: University of California, Office of the President

Throughout the focus groups held on campuses, faculty and administrators were asked about the effect of the existing utilization standards. A consistent response was that utilization cannot be improved further without devoting an unreasonable amount of support budget resources. All support budgets are derived from a basic student/faculty ratio, a ratio that must be adhered to if the total student enrollment is to be served within available funding. Sound educational practice, caused by the increasing complexity of the material in any discipline, requires smaller classes to be held at the upper-division than at the lower-division level, and still smaller classes at the graduate than the upper-division level. Support budget formulas are always based on this principle, and all administrators know that if a significant number of lower-division courses are offered that enroll only ten students,

DISPLAY 8 *Distribution of Assignable Square Feet at the University of California (Excluding All Residential and Health Sciences Space), 1971, 1984, and 1988*

Space Category	1969[1] Percent	1984[2] Percent	1988[3] Percent	1988[3] ASF
Classrooms	5.0	3.9	4.0	825,335
Class Laboratories	11.0	7.9	8.0	1,651,444
Non-Class laboratories	17.0	19.6	18.3	3,811,993
Office Facilities	24.0	27.7	28.8	5,970,854
Study Facilities	11.0	10.9	10.8	2,238,965
Special Use Facilities (EDP Computers, Athletics, Media)	8.0	8.2	9.2	1,919,703
General Use Facilities (Commons, Assembly, Food Service)	10.0	5.8	5.4	1,123,945
Support Facilities (Vivaria, Grnhses, Shops, Stor, Lckr)	12.0	14.6	13.3	2,764,777
Unassigned	2.0	1.4	2.2	455,416
Total	100.0	100.0	100.0	20,762,432

1. Source: CCHE, 1971.
2. Source: Letter from Trudis L. Heinecke to William L. Storey, January 16, 1986.
3. Source: University of California. Fall 1988 Facilities Inventory.

some other courses will have to be offered that enroll many more. The incentive of this system, therefore, is always to gravitate toward the center, to attempt to offer as many courses as possible at the average for the level of instruction involved.

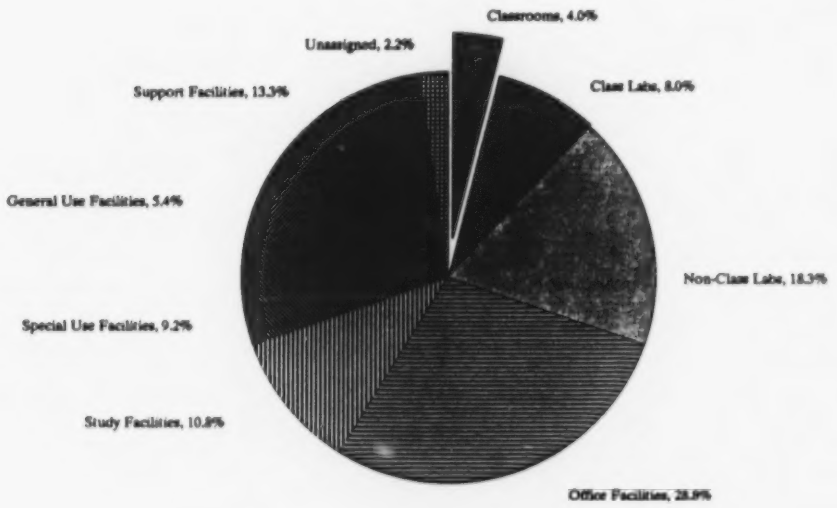
When asked why more courses could not be offered at unpopular hours -- generally in the late afternoon or evening -- faculty members and administrators responded that attempts had been made to do so in the interest of improving utilization, but when the student/faculty ratio continually fell below acceptable levels, the strains on the support budget became so great that the effort was abandoned, especially because the low enrollments generated did little to improve station utilization anyway. Such off-hour scheduling was attempted for both required and elective courses, but a common result was that students merely decided to delay graduation for a term or two. MGT spoke to many of these complexities in its final report (pp. 22, 25):

> Increasing hours of room use per week would simply shift inefficiency from room use hours to station occupancy since, although rooms would be used more, enrollments would be spread over more available station hours, reducing the [station] occupancy rate.
>
> The market for higher education is affected by many factors. Demand factors include a variety of issues related to student and instructor preferences. If students prefer to avoid late afternoon classes, for example, they may choose to enroll for an extra term rather than shift their schedules. Other, less controllable factors not related to supply or demand include constraints resulting from institutional mission, student population characteristics, commuting requirements, employment patterns, etc. It may simply not be possible for a campus to increase utilization due to these constraints.

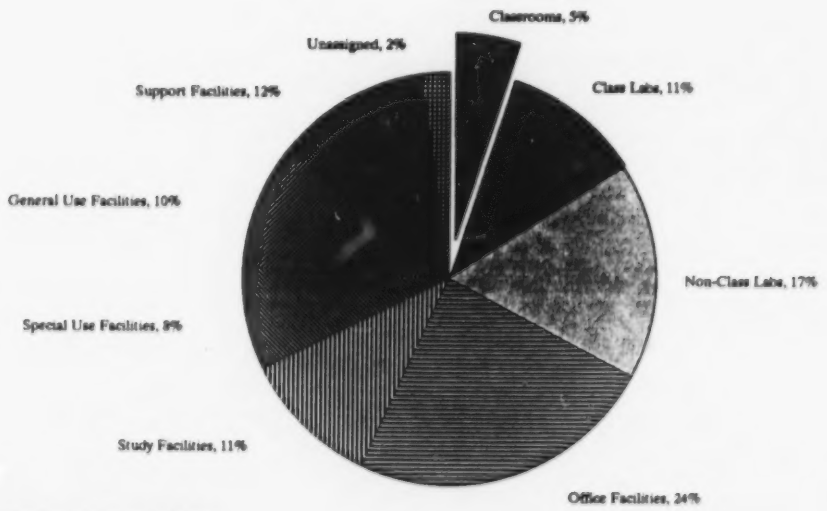
Another aspect of the classroom utilization question is the increasing trend toward holding lecture sections in teaching laboratories -- a phenomenon that may, at least partially, have resulted from the restrictions on classroom construction that have occurred since 1970. In virtually all of the focus-group sessions, faculty noted that they are giving

DISPLAY 9 *Percent Distribution of Non-Residential Assignable Square Feet by Type of Space at the University of California, Fall 1988 and Fall 1969*

FALL 1988



FALL 1969



Special Use – EDP Computers, Athletics, Media
General Use – Commons, Assembly, Food Service
Support Space – Vivaria, Greenhouses, Shops, Storage, Locker

Source: Display 8.

DISPLAY 10 California State University Inventory, Fall 1970 Through Fall 1987

Year	Assignable Square Feet	Classrooms	Teaching Laboratories	Research Laboratories	Offices	Library	Special Use[1]	General Use[2]	Support[3]	Total
Fall, 1970	12,128,243	12.1%	26.9%	2.4%	19.4%	10.3%	11.3%	4.2%	13.4%	100.0%
Fall, 1971	12,964,036	11.5%	26.4%	2.5%	19.4%	162.0%	10.7%	4.1%	13.4%	100.0%
Fall, 1972	13,768,715	11.2%	26.8%	2.7%	19.3%	12.3%	10.1%	3.9%	13.7%	100.0%
Fall, 1973	13,953,658	10.8%	26.2%	3.0%	19.4%	12.1%	10.2%	4.1%	14.1%	99.9%
Fall, 1974	14,639,301	10.2%	25.2%	2.1%	18.9%	12.6%	16.7%	7.6%	6.7%	100.0%
Fall, 1975	15,342,701	9.7%	24.7%	2.1%	19.1%	12.9%	16.4%	7.8%	7.3%	100.0%
Fall, 1976	15,952,867	9.3%	24.2%	2.1%	19.4%	13.1%	16.3%	8.0%	7.6%	100.0%
Fall, 1977	16,509,617	9.0%	23.9%	2.2%	20.2%	13.2%	16.3%	8.4%	6.8%	100.0%
Fall, 1978	16,216,736	9.1%	24.5%	2.4%	20.7%	13.1%	16.6%	7.0%	6.6%	100.0%
Fall, 1979	17,129,159	8.6%	23.2%	2.4%	20.4%	12.3%	19.3%	7.0%	6.9%	100.1%
Fall, 1980	17,463,637	8.5%	22.9%	2.2%	19.0%	13.2%	13.9%	12.0%	8.3%	100.0%
Spring, 1982	17,677,613	8.5%	23.4%	2.2%	19.3%	13.3%	13.8%	12.5%	7.0%	100.0%
Fall, 1983	17,775,566	8.4%	23.4%	2.2%	19.4%	13.3%	10.6%	10.0%	1.7%	100.0%
Fall, 1984	17,799,923	8.4%	23.4%	2.3%	19.5%	13.0%	10.6%	9.9%	1.9%	100.0%
Fall, 1986	18,548,198	8.0%	21.6%	2.2%	19.1%	12.9%	11.9%	14.5%	9.8%	100.0%
Fall, 1987	18,431,480	8.3%	22.1%	1.8%	20.4%	13.4%	12.1%	12.2%	9.7%	100.0%

1. Special Use: consists of armories, physical education, audio/visual, radio-TV, demonstration, and field service spaces.
2. General Use Space: consists of assembly, exhibition, merchandising, recreation, and lounge spaces.
3. Support: consists of data processing, shop, storage, and other support spaces.

Source: California State University, Office of the Chancellor, *Statistical Abstract, July 1987*, p. 401, and updated material for Fall 1987 from the Division of Physical Planning and Development, July 1989.

lectures more often in laboratories, in part because of the lack of classroom space but also because needed equipment -- particularly computers -- are available in laboratories but not in classrooms. Also, since there are equipment deficiencies in many classrooms (an absence of television monitors, slide and overhead projectors, and demonstration facilities), faculty often find that teaching can be improved when conducted in a laboratory setting.

The trend toward using teaching laboratories as classrooms is most easily seen in the California State University, since that segment maintains the most comprehensive and consistent utilization information. Display 13 shows an array of space use for Fall 1987 and indicates that 19.8 percent of all lecture full-time-equivalent enrollment is now generated in other than lecture spaces, with 12.3 percent coming from teaching laboratories. Altogether, lecture full-time-equivalent enrollment was produced in 49 room types other than classrooms.

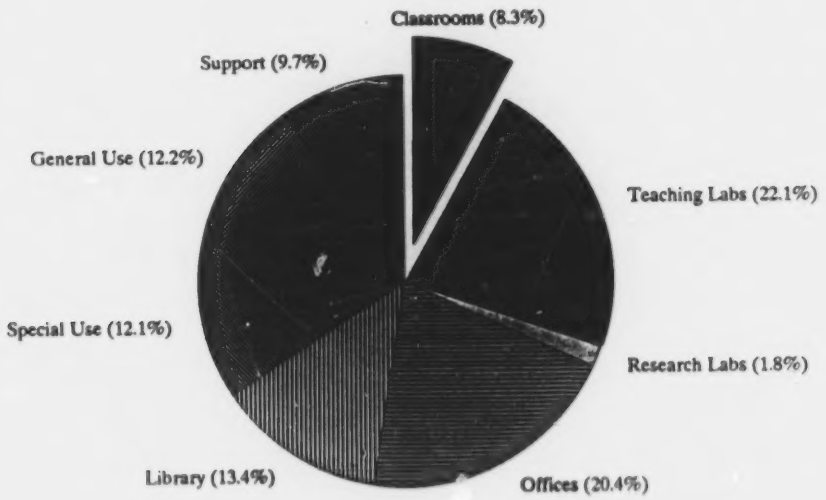
There is no way to determine if these percentages represent a major change from 1970 and earlier practices, but there is strong anecdotal evidence from the focus groups that a change has occurred. In part, that may be due to differences in pedagogical philosophy, but MGT noted that the "inability to justify new space or modify existing space may begin to drive curriculum . . ." (ibid).

Utilization patterns

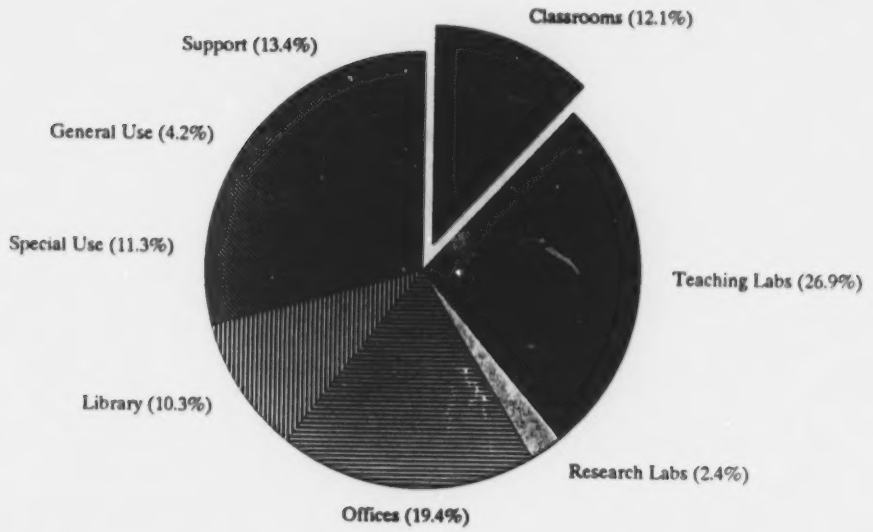
As noted earlier, the California State University annually develops the most comprehensive utilization information of any of the segments, and those data reveal some interesting patterns that are re-

DISPLAY 11 *Percent Distribution of Non-Residential Assignable Square Feet by Type of Space at the California State University, Fall 1987 and Fall 1970*

FALL 1987



FALL 1970

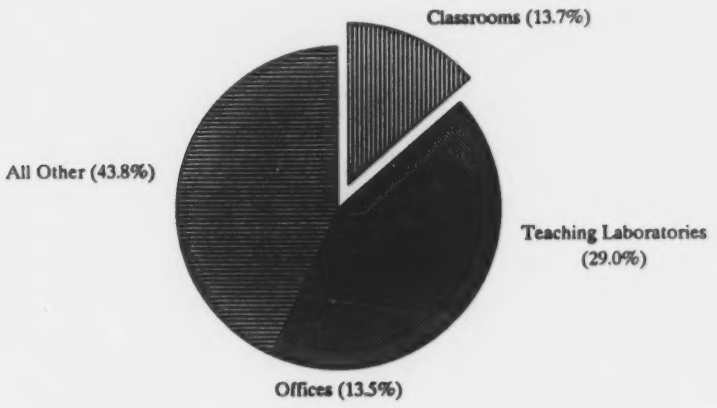


Special Use – Armories, P.E., Audio Visual, Radio-TV, Demonstration, Field Service
General Use – Assembly, Exhibition, Merchandising, Recreation, and Lounge Spaces
Support Space – Data Processing, Shops, Storage, Other.

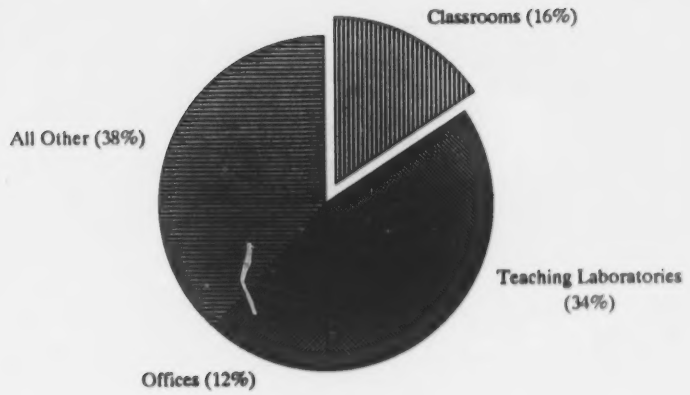
Source: Display 10.

DISPLAY 12 *Percent Distribution of Non-Residential Assignable Square Feet by Type of Space at the California Community Colleges, Fall 1988 and Fall 1969*

FALL 1988



FALL 1969



Source: CCHE, 1971; and Chancellor's Office, 1989.

DISPLAY 13 Full-Time-Equivalent Students of the California State University Arrayed by Method of Instruction and Room Type, Fall 1987

Room Code	Room Type	Lecture FTE	Laboratory FTE	Activity Lecture FTE	Activity Laboratory FTE	Independent Study FTE	Other FTE	Totals
01	Lecture	160,319.5	417.2	439.9	1,654.4	381.1	512.6	163,724.7
10	Teaching Lab	21,189.3	7,735.4	168.8	5,910.4	244.9	703.4	35,952.2
11	Teaching Lab Srvc	359.2	62.3	0.0	61.3	10.6	7.2	500.6
16	Research Lab	682.0	99.7	0.0	11.2	13.2	9.0	815.1
17	Research Lab Srvc	3.8	2.2	0.0	8.8	0.7	0.0	15.5
19	Self Inst Cmp Lab	1,335.9	109.0	0.7	199.0	0.2	4.4	1,649.2
20	Self Inst Labora.	823.0	13.8	4.2	63.5	4.8	65.3	974.6
21	Music Practice Std	127.2	0.0	7.2	12.4	4.1	11.9	162.8
22	Phys Ed-Indoor	354.4	13.4	0.0	176.1	0.0	2,022.8	2,566.7
23	Phys Ed-outdoor	0.0	0.0	0.0	0.0	0.0	2,475.2	2,475.2
25	Animal Quarters	0.0	2.6	0.0	0.0	0.0	0.0	2.6
26	Greenhouse	1.2	2.0	0.0	0.0	0.0	0.0	3.2
27	Spcl Educ Space	467.3	2.7	0.0	2.3	3.3	0.0	475.6
28	Radio/TV	237.5	31.0	0.0	42.9	0.0	9.2	320.6
29	Spcl Purpose Space	1,641.4	18.1	1.0	86.3	26.1	82.7	1,855.6
30	Profess Faculty	156.8	0.9	0.0	17.6	60.3	3.0	238.6
31	Clrcl Faculty	27.2	0.0	0.0	0.0	10.8	5.5	43.5
32	Srvc Facility	49.6	0.0	0.0	0.9	0.0	0.0	50.5
35	Profess Fac/Admin	62.6	0.0	0.0	0.0	28.5	6.7	97.8
36	Clrcl Fac/Admin	285.6	0.6	1.7	8.0	328.3	9.2	633.4
37	Srvc, Fac/Admin	2.6	0.0	0.0	1.9	2.2	5.2	11.9
40	Profess. Admin Off	0.0	0.0	0.0	0.0	0.0	0.8	0.8
41	Clerical Admin Off	15.4	0.0	0.0	0.8	0.0	0.0	16.2
42	Service, Admin Off	140.2	0.0	0.0	0.0	1.0	0.0	141.2
45	Student Off, Gen	128.7	0.0	0.0	0.6	0.0	2.1	131.4
47	Student Off, Srvc	0.0	0.0	0.0	19.2	0.0	0.0	19.2
49	Other Office	44.4	0.0	0.0	0.0	3.8	3.6	51.8
51	Conference Room	426.3	0.8	0.0	26.1	20.3	14.8	488.3
52	Lounge	0.0	0.0	0.0	0.0	4.2	0.0	4.2
53	Recreation	8.8	7.2	0.0	0.0	0.0	0.0	16.0
56	General Storage	16.8	3.5	0.0	1.2	4.4	0.0	25.9
57	Warehouse	0.0	9.5	0.0	0.0	0.0	0.0	9.5
63	Other Spcl Stdy Ar	46.1	0.0	0.0	2.4	0.0	2.2	50.7
66	Stacks-Student	235.6	0.0	0.0	0.0	2.0	2.6	240.2
70	Museum/Gallery	181.2	17.2	0.0	2.0	2.0	0.0	202.4
75	Auditoria	2,041.7	4.0	0.0	111.7	9.6	122.0	2,289.0
77	Stage	49.7	0.0	0.0	3.5	0.0	2.7	55.9
79	Auditorium Srvc	195.6	5.2	0.8	42.5	0.4	26.6	271.1
81	Locker Room	11.4	25.1	0.0	0.0	4.4	0.0	40.9
83	Main/Repair	44.5	2.7	0.0	0.0	0.0	0.0	47.2
84	Field Area	4.5	17.6	0.0	2.8	0.0	0.0	24.9
85	Other Sports	549.6	11.9	8.9	61.0	19.6	83.7	734.7
91	Student Use	129.1	0.0	6.1	13.5	0.0	0.0	148.7
92	Adminis Use	59.7	1.3	3.8	11.4	0.0	0.0	76.2
93	Faculty Use	18.3	0.0	0.0	3.2	0.0	0.0	21.5
99	Other	877.7	0.0	0.0	22.6	0.0	2.8	903.1
	Outdoor	199.9	33.9	6.6	53.4	140.2	13.6	447.6
	To Be Announced	5,728.1	257.7	95.2	817.3	6,846.3	1,688.8	15,433.4
	Off Campus	299.5	10.8	0.0	14.7	796.3	412.9	1,534.2
	Total	199,578.9	8,919.3	744.9	9,466.9	8,973.6	8,312.5	235,996.1
	Total	199,578.9	8,919.3	744.9	9,466.9	8,973.6	8,312.5	235,996.1

Percent lecture in lecture	80.2%	Percent lecture outdoors	0.1%
Percent lecture in all type labs	12.3%	Percent lecture to be announced	2.9%
Percent lecture in all other	4.3%	Percent lecture off-campus	0.1%
		Total lecture	100.0%

Source: The California State University, 1987

flected in displays 14-19. Available data from the University of California reveal patterns very similar to those in the State University, at least during the 8 a.m. to 5 p.m. time period. The community colleges have not yet developed a formal data system to measure utilization, but from the focus groups, it seems clear that their pattern of classroom usage also closely parallels the pattern in the State University.

During the debates on Assembly Concurrent Resolution 151, its proponents based their arguments on two primary premises, first that classrooms could be used in the evening (5 p.m. to 10 p.m.) at the same rate (75 percent of the available hours) as during the day, and second that the utilization experience at two State University campuses -- Long Beach and Fullerton -- was representative of the entire system. Both of those premises now appear to be faulty. In its final report, MGT stressed that the academic enterprise is so complex that it is difficult to apply general utilization rules across the board. Just as the three public segments in California have very different missions, so also do campuses within those systems live with circumstances that make classroom utilization standards more, or less, possible to achieve. As an example, campuses with large evening degree programs will have a far easier time meeting the utilization standard than those without such programs. Campuses where a large proportion of the students work and attend school part time will have a very difficult time scheduling classes in the late afternoons, and all campuses will have difficulty on Friday afternoons and evenings. Campuses where the match between course size and room size is poor will also exhibit lower utilization rates than campuses where the fit is better. Finally, impacted campuses may often meet or even exceed the standard, while underenrolled campuses will show very poor utilization rates.

Concerning impaction, Displays 14 and 15 show the differences in utilization rates in the California State University for Fall 1987 compared to physical plant capacity and capacity enrollment. The correlation coefficient shown on the bottom of Display 14 is 0.83, which indicates a very close fit between impaction and utilization. This is also shown in the upper right portion of Display 15. Display 16 shows a summary of State University utilization for Fall 1987 by campus, with Displays 17, 18, and 19 showing graphic presentations of the patterns of weekly room hours, station occupancy percentages, and weekly station hours. Display 20 shows classroom utilization for the University of California's Davis campus throughout the day. While room use and station occupancy are not comparable indices, it will nevertheless be observed that the use patterns in the two segments are relatively similar, except that the State University's evening program generates far greater utilization than does the Davis campus during late hours. On Friday afternoons, classrooms are generally not in use. (Display 7 on page 39 above showed actual utilization data by room size for the Davis campus as well as Santa Cruz.)

As noted above, another factor that can influence utilization success is the match between room and course size. In its final report, MGT provided a hypothetical example of how this match can work, and Display 21 borrows from that example to illustrate how utilization levels can deteriorate when the fit between rooms and courses is not good. This display indicates that while 1,711 courses are taught in rooms with between 0 and 40 seats, there is a need for space for 2,422 courses in rooms of that size. The result is that smaller courses are moved to larger classrooms, where station occupancy, and ultimately, weekly station hours, suffer. This can produce an effect where a campus is actually meeting the weekly room hour component of the utilization formula, but still cannot achieve the 35 weekly station hour standard because of below standard occupancy rates.

Comparison to national norms

As is well known, California pioneered the use of space and utilization standards in higher education and developed the widely copied space factor formula in 1966 that combines the space-per-station standard with the utilization standard to produce a given number of assignable square feet per weekly student contact hour. It has been suggested that other states not only copied the formula but also the numbers in the formula, yet the data from MGT's national survey appear to suggest a different conclusion.

Had the numbers in the formula -- the classroom standards themselves -- merely been adopted on a wholesale basis elsewhere, those standards should be relatively similar, yet such is not the case. For example, the variance between lower-division stan-

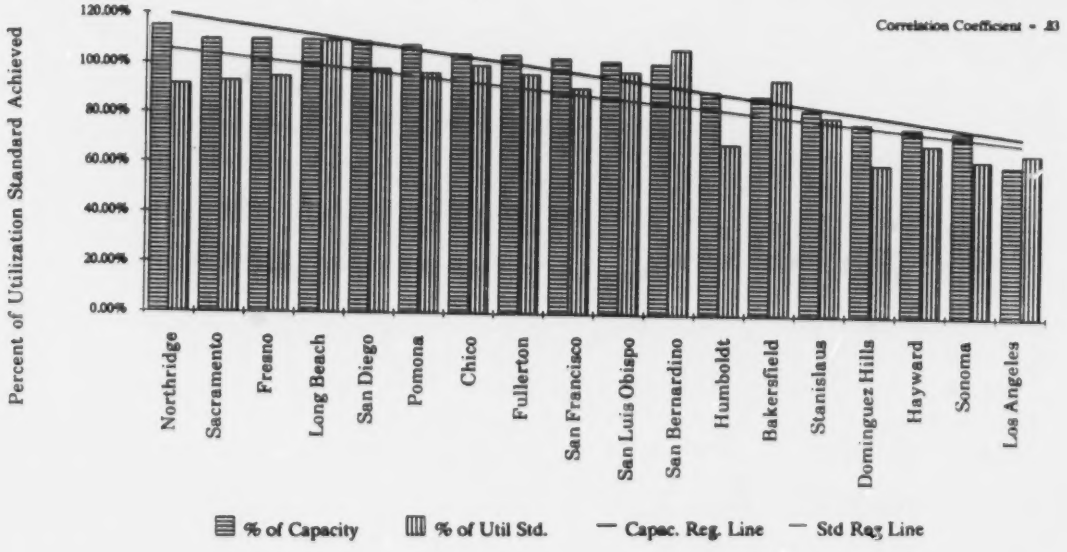
DISPLAY 14 Utilization Analysis for the California State University, Fall 1987 Totals

Campus	Physical Capacity	Capacity Enrollments	Enrollment as a Percent of Capacity	Percent of Util Standard Achieved
Northridge	17,201	19,798	115.1%	91.4%
Sacramento	15,177	16,683	109.9%	93.0%
Fresno	11,937	13,113	109.9%	94.7%
Long Beach	19,804	21,712	109.6%	109.3%
San Diego	21,580	23,525	109.0%	97.8%
Pomona	12,333	13,275	107.6%	96.3%
Chico	11,973	12,474	104.2%	99.5%
Fullerton	14,947	15,518	103.8%	96.2%
San Francisco	16,348	16,807	102.8%	90.7%
San Luis Obispo	13,132	13,334	101.5%	97.3%
San Bernardino	4,140	4,171	100.7%	106.7%
Humboldt	5,990	5,361	89.5%	68.3%
Bakersfield	3,099	2,725	87.9%	94.5%
Stanislaus	3,696	3,049	82.5%	79.6%
Dominguez Hills	6,533	5,036	77.1%	60.8%
Hayward	10,857	8,199	75.5%	68.8%
Sonoma	5,288	3,921	74.1%	62.6%
Los Angeles	20,136	12,197	60.6%	65.3%
All Campuses	214,171	210,898	98.5%	90.0%

Correlation Coefficient between the percentage columns equals .83.

Source: California State University, Division of Physical Planning and Development

DISPLAY 15 Comparison Between Campus Enrollments and Capacities, and Weekly Station Hour Experience in the California State University, Fall 1987



Source: Display 14.

DISPLAY 16 *Classroom Utilization Analysis for the California State University, Showing Weekly Room Hours (WRH), Station Occupancy Percentage (SOP), and Weekly Station Hours (WSH), Fall 1987*

	Monday			Tuesday			Wednesday			Thursday			Friday		
Campus	WRH	SOP	WSH	WRH	SOP	WSH	WRH	SOP	WSH	WRH	SOP	WSH	WRH	SOP	WSH
Bakersfield	9.305	83.0%	7.764	9.365	79.5%	7.411	8.671	82.4%	7.173	9.317	81.1%	7.541	3.964	45.5%	3.177
Chico	9.956	80.3	7.712	10.781	69.3	7.695	10.374	70.6	7.482	9.682	73.6	7.289	6.185	169.8	4.648
Dominguez Hills	7.713	61.6	4.802	8.208	65.6	5.378	7.604	60.6	4.658	7.898	65.8	5.213	2.386	42.5	1.557
Fresno	10.429	63.3	6.933	10.712	65.9	7.259	10.676	64.6	7.195	9.951	65.5	6.802	6.634	71.8	4.944
Fullerton	10.235	71.9	7.487	10.844	72.2	7.901	10.407	71.6	7.536	9.794	74.3	7.413	3.947	53.2	3.332
Hayward	8.458	58.9	5.395	8.303	58.1	4.977	8.425	58.6	5.346	7.439	59.0	4.582	5.052	39.9	3.770
Humboldt	7.612	63.5	5.008	8.656	60.7	5.373	7.638	62.7	4.846	8.194	58.2	5.115	5.314	50.5	3.557
Long Beach	9.692	85.4	8.444	10.027	87.2	8.980	9.492	85.1	8.281	9.663	88.1	8.749	3.890	74.6	3.732
Los Angeles	8.164	67.4	5.466	8.560	69.3	5.978	8.087	66.3	5.316	8.362	67.5	5.694	1.260	41.7	0.814
Northridge	9.082	69.4	6.631	9.952	71.3	7.338	9.599	71.1	7.115	9.171	68.7	6.661	5.094	52.2	4.259
Pomona	10.008	73.5	7.649	9.174	69.6	6.532	10.047	73.7	7.677	8.844	68.6	6.309	5.663	58.0	4.596
Sacramento	10.147	65.3	6.858	11.106	69.1	7.815	10.309	63.5	6.816	10.433	68.6	7.389	5.446	58.0	4.151
San Bernardino	9.366	86.3	8.075	10.411	81.9	8.423	9.375	85.9	8.036	10.385	82.0	8.426	4.426	54.5	4.381
San Diego	9.232	75.3	7.154	9.796	81.2	8.107	9.578	72.1	7.150	9.219	77.6	7.469	5.029	68.4	4.349
San Francisco	10.944	60.5	6.766	11.504	64.2	7.501	10.892	60.3	6.724	10.911	62.7	7.035	5.830	52.5	4.044
San Luis Obispo	10.387	69.4	7.568	9.681	73.7	7.099	10.262	74.7	7.578	9.131	68.7	6.648	6.364	53.3	4.685
Sonoma	7.294	66.1	4.889	7.286	75.2	5.328	8.362	58.9	5.020	7.012	67.8	4.776	2.978	35.8	1.881
Stanislaus	10.035	62.5	6.735	9.398	56.5	5.431	10.128	62.0	6.643	8.529	52.6	4.762	5.450	44.7	4.287
All Campuses	**9.524**	**70.2%**	**6.872**	**9.898**	**70.6%**	**7.208**	**9.647**	**69.1%**	**6.870**	**9.306**	**69.5%**	**6.793**	**4.812**	**59.3%**	**3.784**

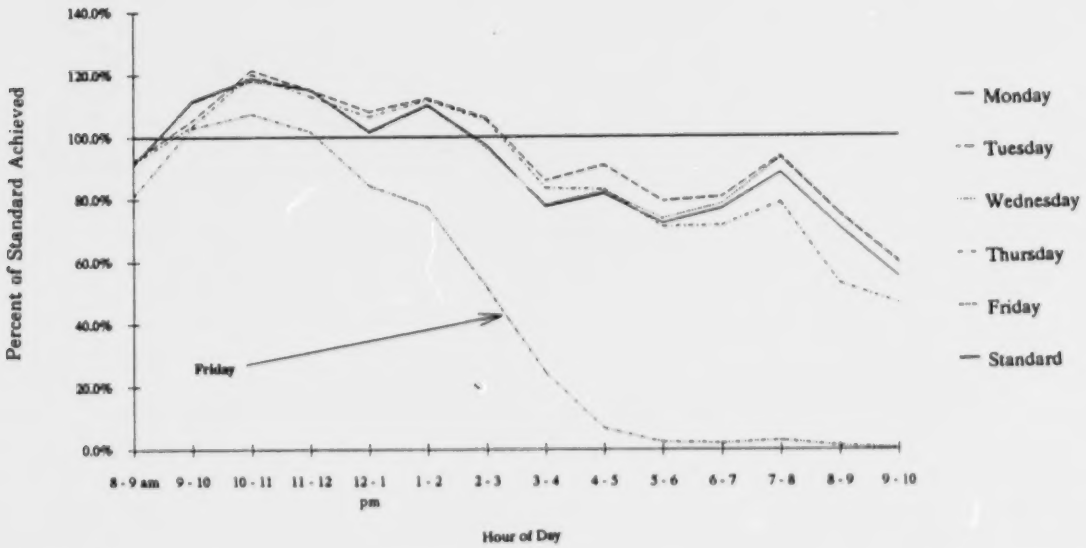
Source: California State University, 1987

dards for the state with the most generous standards versus that with the most strict standards varies by 67.4 percent for lower-division research university classrooms, 64.4 percent for state university classrooms, and 32.2 percent for community college classrooms. Comparable percentages are observable for upper-division and graduate spaces.

There is also no category of space (classrooms, teaching laboratories, etc.) where the standards currently in use in California are more divergent from national practice. Displays 22 through 27 on pages 51 through 55 show the results from MGT's survey, and those results are more striking than for the comparisons of any of the three other types of space under consideration in this project. For the research university prototype system, mean national standards provide for about 65 percent more classroom space than do the current standards in California, with the comparable percentages for the State University and community college prototype institutions recorded at about 55 to 60 percent.

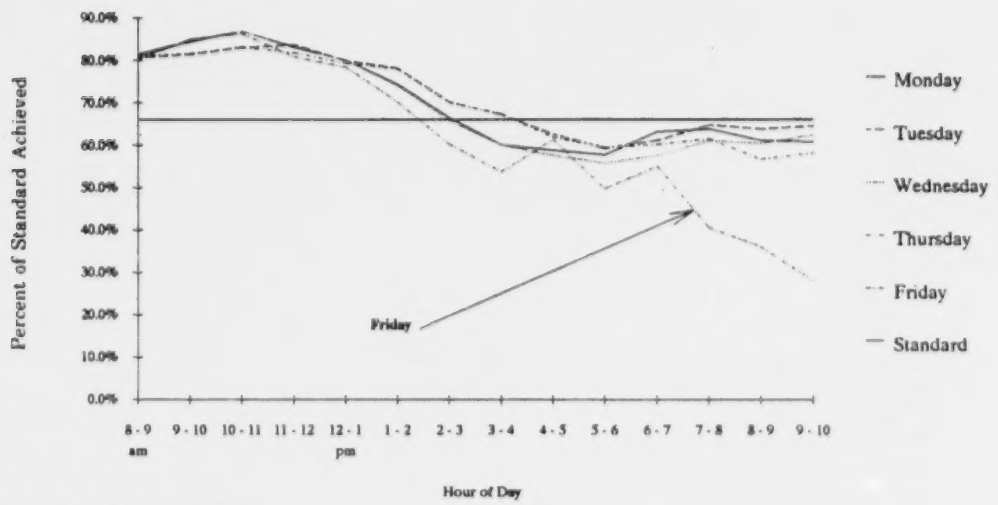
It can always be argued, of course, that California remains the leader in its insistence on high levels of utilization and that other states have merely failed to keep up with its unique experiment in stringency. There is probably a degree of truth in this assertion, since the available national utilization data suggest that California not only has the strictest standards, it also utilizes its classrooms most efficiently. The Commission noted this phenomenon in *Time and Territory*, where the preliminary data developed in 1985 seemed to indicate that actual utilization failed to meet the standards in any state, regardless of what those standards were. Consequently, while the utilization data developed by the

DISPLAY 17 Weekly Room Hour Utilization for California State University Classrooms, Fall 1987



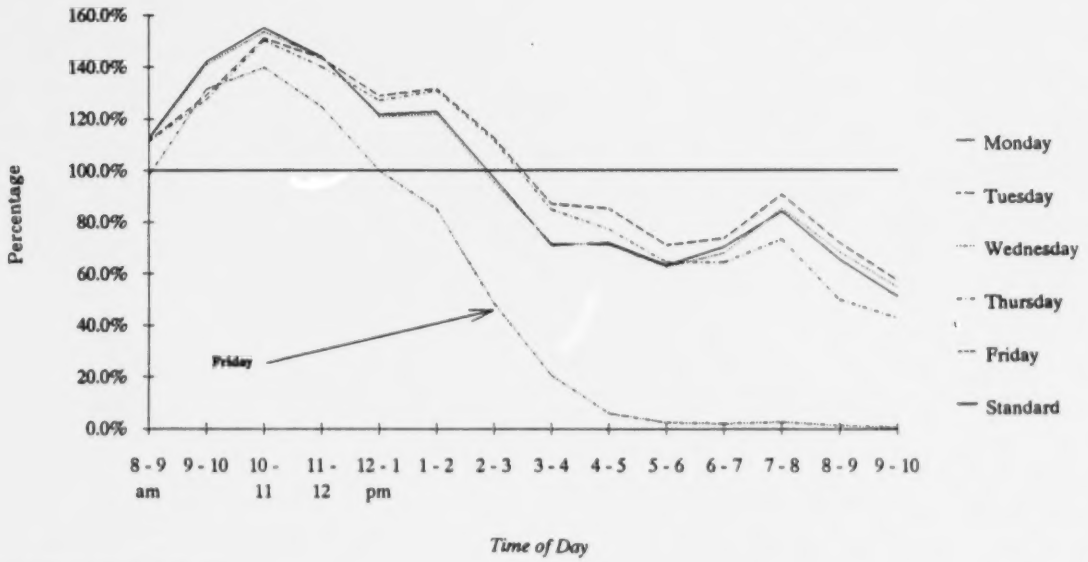
Source: California State University, 1988

DISPLAY 18 Station Occupancy Percentage for California State University Classrooms, Fall 1987



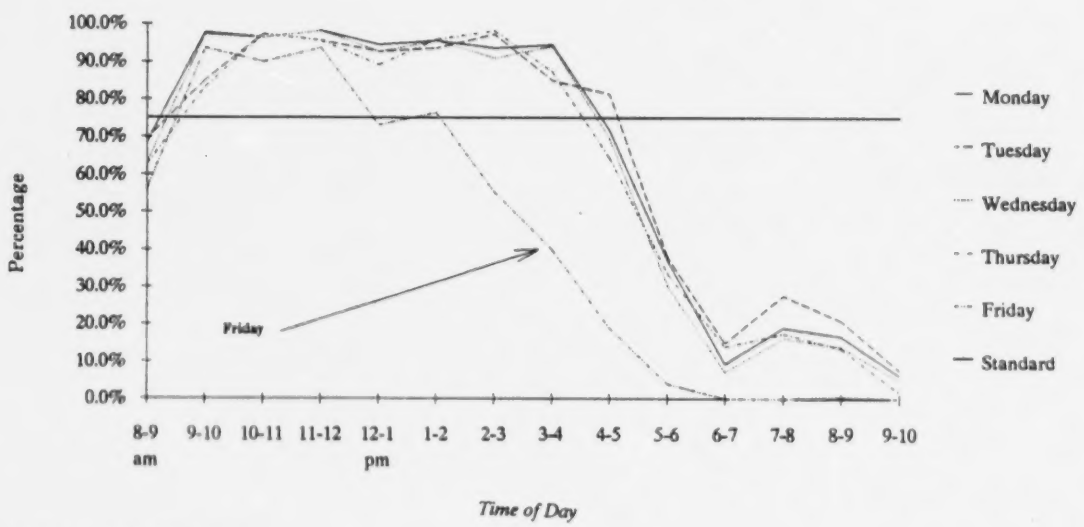
Source: California State University, 1988

DISPLAY 19 ***Weekly Station Hour Utilization for California State University Classrooms, Fall 1987***



Source: California State University, 1988

DISPLAY 20 ***Weekly Room Hour Utilization at the University of California, Davis, Fall 1987***



Source: Univ. of Calif., Office of the President

DISPLAY 21 *Comparison of Actual Rooms Versus Rooms Needed for Class Sizes Under Different Room Use Assumptions on a Hypothetical Campus*

(1) Size Category	(2) # Rooms of that Size	(3) # Courses[1] Taught in Those Rooms[2]	(4) # Courses with Enrollment of that Size	(5) # Rooms Needed Based on 36 hrs/wk[3]	(6) Net Need for Classrooms Based on 36 hrs/wk	(7) # Rooms Needed Based on 53 hrs/wk[4]	(8) Net Need for Classrooms Based on 53 hrs/wk
0 - 40	114	1,711	2,422	166	+52	113	-1
41 - 60	37	605	185	13	-24	9	-28
61 - 100	26	326	169	12	-14	8	-18
101 - 200	16	185	140	9	-7	7	-9
201 and over	12	159	70	5	-7	4	-8
Total	*205*	*2,986*	*2,986*	*205*	*0*	*141*	*-64*

1. Primary and secondary (e.g. lab, discussion) sessions.
2. General assignment classrooms and seminar rooms.
3. Based on the actual average assignment pattern of 14.56 sections per room.
4. Based on the actual average assignment pattern adjusted to 53 hours per week room use or 21.44 sections per room.

Source: MGT Consultants, 1989c, p. 21.

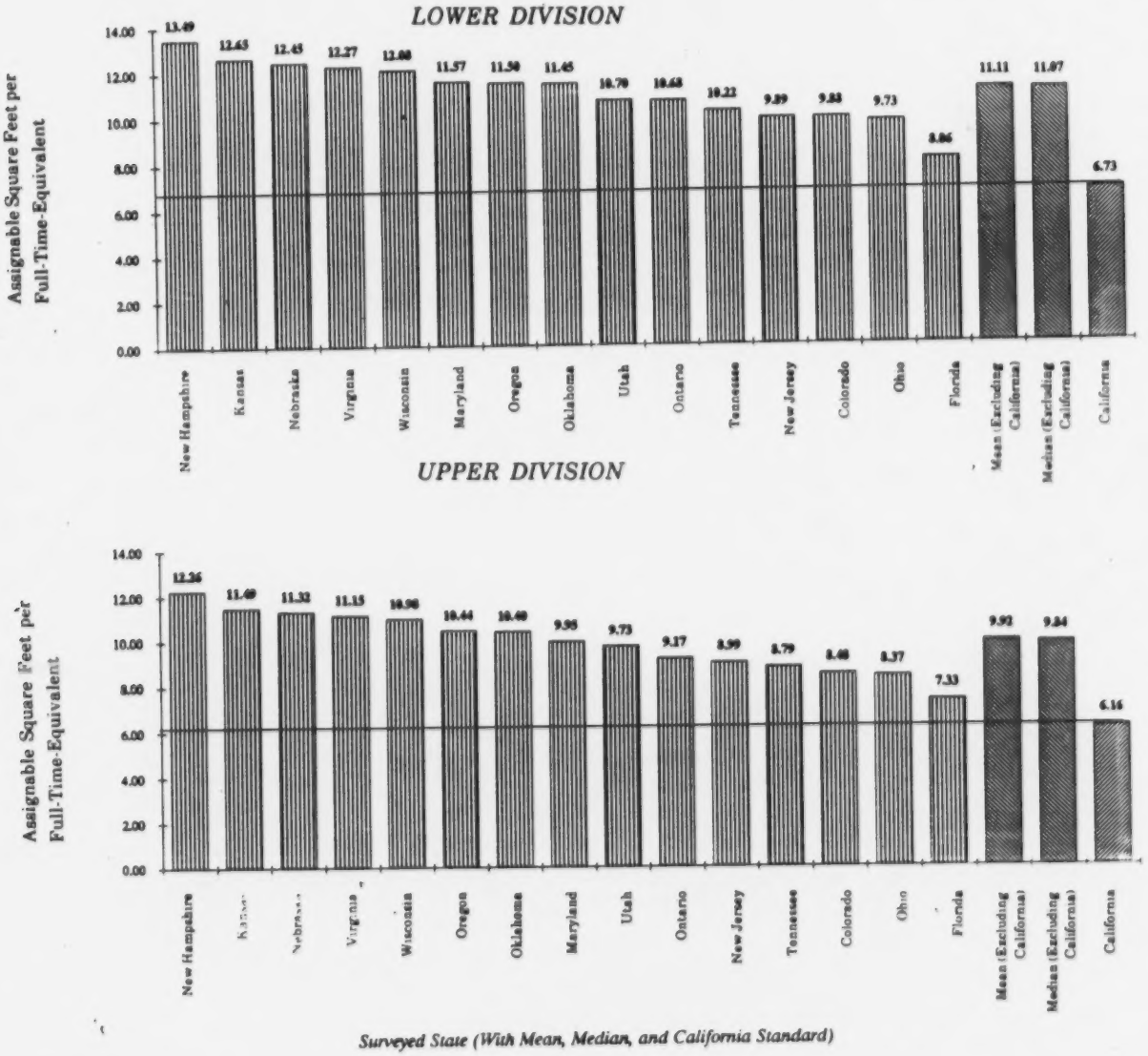
DISPLAY 22 *National Survey Comparisons of Assignable Square Feet per Full-Time Equivalent Student for Classrooms (Research University Prototype)*

Assignable Square Feet per Full-Time-Equivalent Student

Lower Division State	Normalized Factor	Upper Division State	Normalized Factor	Graduate I State	Normalized Factor	Graduate II State	Normalized Factor
NH	13.49	NH	12.26	NH	8.37	NH	8.37
KS	12.65	KS	11.49	KS	7.86	OK	8.30
NE	12.45	NE	11.32	NE	7.73	MD	7.95
VA	12.27	VA	11.15	VA	7.62	KS	7.86
WI	12.08	WI	10.98	OK	7.58	NE	7.73
MD	11.57	OR	10.44	WI	7.49	VA	7.62
OR	11.50	OK	10.40	MD	7.18	WI	7.49
OK	11.45	MD	9.95	OR	7.13	ONT	7.37
UT	10.70	UT	9.73	TN	7.03	OR	7.13
ONT	10.68	ONT	9.17	UT	6.65	TN	7.03
TN	10.22	NJ	8.99	ONT	6.63	CO	6.82
NJ	9.89	TN	8.79	CO	6.14	OH	6.69
CO	9.88	CO	8.48	NJ	6.14	UT	6.65
OH	9.73	OH	8.37	OH	6.04	NJ	6.14
FL	8.06	FL	7.33	FL	5.33	FL	5.84
Mean (Excluding Calif)	**11.11**	**Mean (Excluding Calif)**	**9.92**	**Mean (Excluding Calif)**	**6.99**	**Mean (Excluding Calif)**	**7.27**
Median (Excluding Calif)	**11.07**	**Median (Excluding Calif)**	**9.84**	**Median (Excluding Calif)**	**7.08**	**Median (Excluding Calif)**	**7.30**
California	**6.73**	**California**	**6.16**	**California**	**4.23**	**California**	**4.23**

Source: MGT, 1989a

DISPLAY 23 *Comparison of Assignable Square Feet (ASF) per Full-Time-Equivalent Enrollment (FTE) for Classrooms Among the Surveyed States with Classroom Standards in the Research University Prototype, Lower Division and Upper Division*



Source: Display 22.

California segments lead to the conclusion that the existing standards cannot be met, there is a strong case to be made for setting the standards at a level that is both stricter than national norms and challenging to campus space planners. In establishing a 53-hour-room-use standard, the Legislature may have gone too far, but it may also have been on the right track.

DISPLAY 24 National Survey Comparisons of Assignable Square Feet per Weekly Student Contact Hour for Classrooms (State University Prototype)

Lower Division: State	Normalized Factor	Upper Division: State	Normalized Factor	Graduate I: State	Normalized Factor
NH	0.906	NH	0.906	NH	0.906
KS	0.849	KS	0.849	KS	0.849
NE	0.837	NE	0.837	NE	0.837
WI	0.811	WI	0.811	WI	0.811
VA	0.806	VA	0.806	VA	0.806
OR	0.772	OR	0.772	OK	0.801
OK	0.767	OK	0.767	OR	0.772
UT	0.742	UT	0.742	UT	0.742
MD	0.733	MD	0.733	MD	0.690
ONT	0.685	ONT	0.685	NJ	0.672
NJ	0.672	NJ	0.672	ONT	0.645
TN	0.648	TN	0.648	CO	0.634
CO	0.634	CO	0.634	TN	0.611
OH	0.618	OH	0.618	OH	0.583
FL	0.551	FL	0.551	FL	0.565
Mean (Excl. Calif.)	**0.735**	**Mean (Excl. Calif.)**	**0.735**	**Mean (Excl. Calif.)**	**0.728**
Median (Excl. Calif.)	**0.737**	**Median (Excl. Calif.)**	**0.737**	**Median (Excl. Calif.)**	**0.716**
California	**0.462**	**California**	**0.467**	**California**	**0.467**

Source: MGT, 1989a

Constructing a new classroom utilization standard

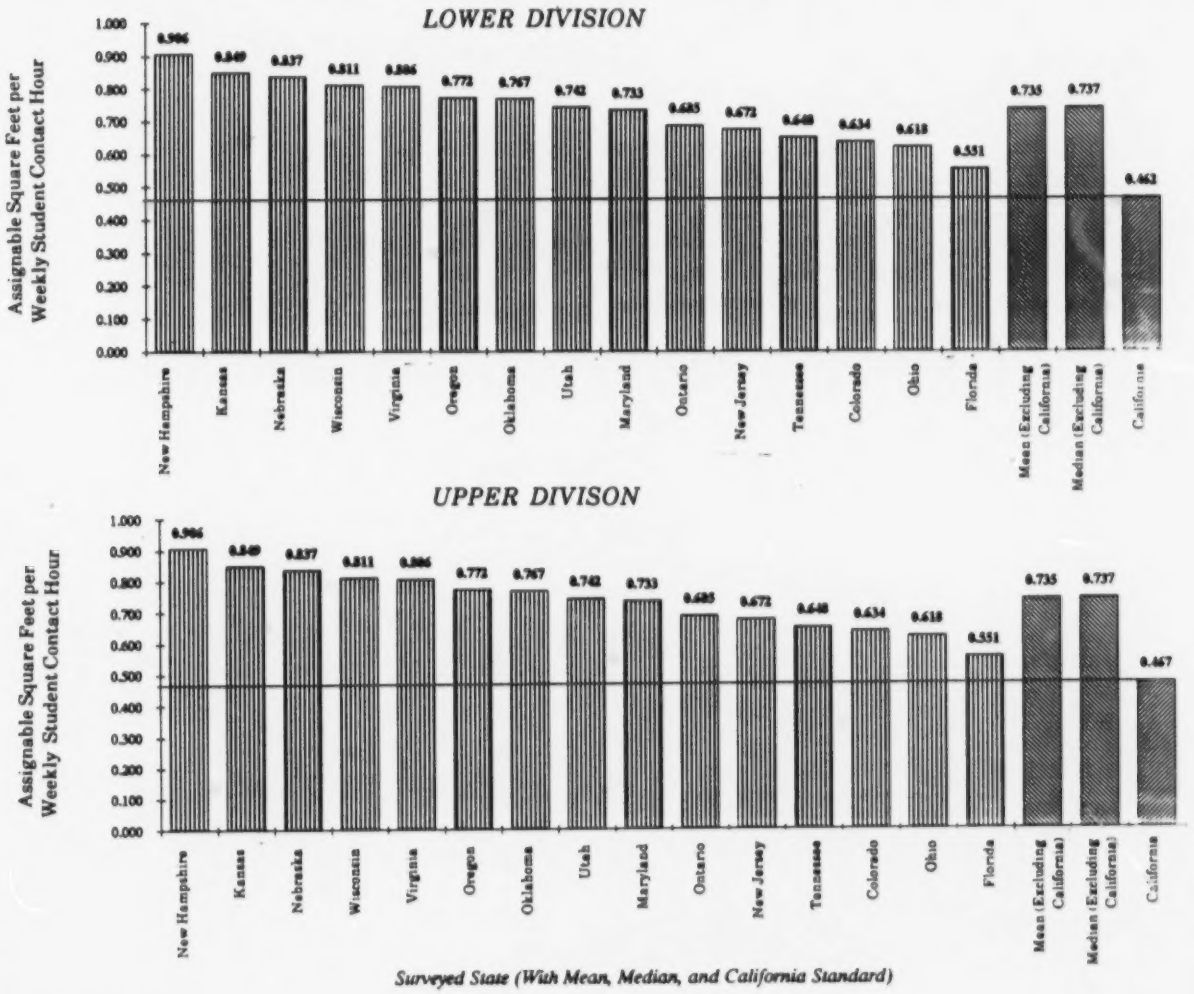
One of the major purposes of this study was to establish space and utilization standards that are both strict and reasonable. Concerning classrooms, the existing standards certainly meet the first criterion, but fail on the second. As noted earlier, when Assembly Concurrent Resolution 151 was approved in 1970, its primary purpose was not to increase utilization per se but to reduce the need for additional construction by substantially increasing capacity. In all probability, that goal was only partially achieved, since the utilization rates established in that year have never been achieved. Where ACR 151 created a theoretical increase in classroom capacity of some 56 percent, actual capacity was probably increased only marginally, particularly in the State University where the 1969 utilization data do not differ substantially from the numbers reported in 1987. Given that fact, the real effect of ACR 151 must be questioned.

From the evidence accumulated in this project, it seems clear that the true effect of the increase in the classroom utilization standard was to create pressures on other types of facilities -- particularly teaching laboratories. Since the teaching laboratory utilization standard was increased by only 10 percent (see Part Five), while the classroom standard increased 56 percent, it became relatively easier to justify teaching laboratory space.

Another factor is that capital outlay appropriations tend to be determined far more by political and fiscal realities than by the standards themselves. Obviously, if the people of the State are unwilling to approve bond issues, facilities will not be built, yet even if bond issues are approved, the Legislature must always face the problem of competing requests from other agencies. In addition, as noted earlier, the financial markets can only absorb a given level of bond sales in any year, and since total capital outlay requests from all agencies inevitably exceed that absorption rate, there will always be a natural restriction on construction projects. Clearly, such restrictions tend to diminish the effect space standards have on the total amount of money appropriated for capital outlay projects.

What space standards can do, however, is establish priorities within overall capital construction plans.

DISPLAY 25 *Comparison of Assignable Square Feet (ASF) per Weekly Student Contact Hour (WSCH) for Classrooms Among the Surveyed States with Classroom Standards in the State University Prototype -- Lower Division and Upper Division*



Source: Display 24.

Between 1970 and the present, it is now clear that the standards have conferred a very low priority to classroom construction, with relatively higher priorities for other kinds of space. Since classrooms are the least expensive kind of space to build, the result has been fewer square feet of construction than would otherwise have been built. Had the standard not been raised to such a high level in 1970, there is no doubt that a greater amount of classroom space would have been constructed, with a proportionate decrease in other kinds of facilities. Thus, rather than saving the State money, the restrictive standards applied to classrooms have probably had the effect of increasing costs overall. To put this another way, the creation of a standard that cannot be met -- and the 17 years of experience with the existing classroom standard clearly indicate that it is unmeetable -- only has the effect of transferring instruction to other, more expensive kinds of facilities. Relaxing the standard to a level that is strict

DISPLAY 26 National Survey Comparisons of Assignable Square Feet per Weekly Student Contact Hour for Classrooms (Community College Prototype)

Lower Division

State	Normalized Factor
Wisconsin	0.852
Utah	0.803
Virginia	0.727
New Jersey	0.672
Florida	0.619
Washington	0.555
Ohio	0.552
Maryland	0.515
Tennessee	0.500
Colorado	0.448
Mean(Excluding California)	0.624
Median (Excluding California)	0.555
California	0.429

Source: MGT, 1989a.

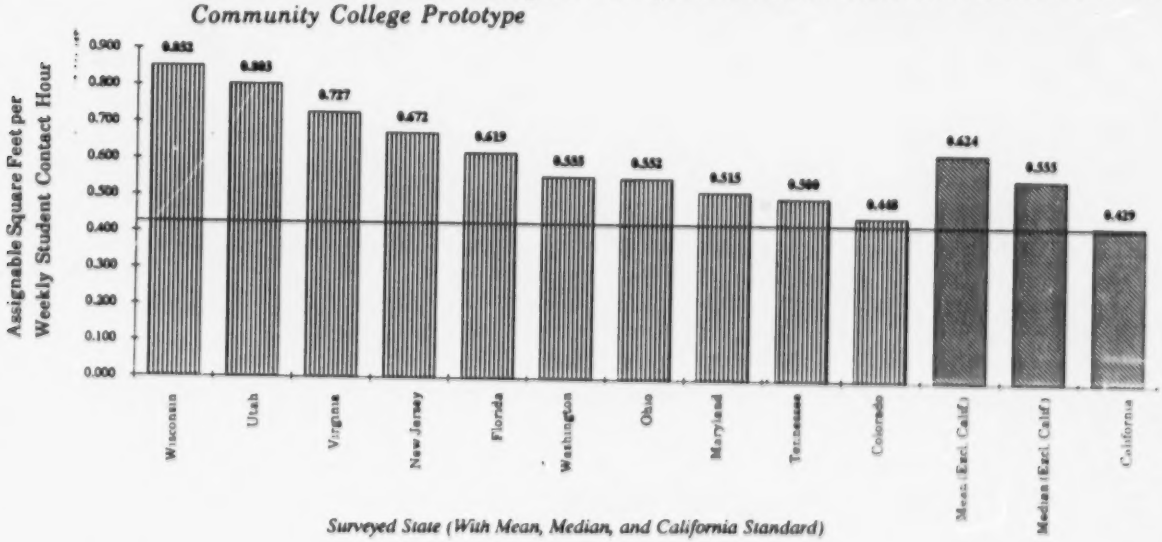
but meetable should go a long way toward redressing the current imbalance.

The left column of Display 28 shows California State University utilization data for the Fall 1987 term arrayed by time blocks and compared to the existing 35-weekly-station-hour standard. Other years could be compared, but they are not sufficiently different from 1987 to justify the effort. The right-hand column of the display also contains a delineation of the new classroom standard. In viewing this display, as well as some of the previous charts, it is clear that while it is relatively easy to exceed the standard at certain times of the day, it is virtually impossible to meet it at others. From this, it is then possible to construct a new standard that is more strict than national norms by a considerable degree but also meetable except in cases where a campus is seriously underenrolled in comparison to its physical plant -- in which case it is unlikely that it would need new classrooms anyway.

The utilization standard suggested in Display 28 is for 30 weekly station hours in each of the three segments, and it is based on three basic premises:

- First, from the comprehensive utilization data provided by the State University, the available

DISPLAY 27 Comparison of Assignable Square Feet (ASF) per Weekly Student Contact Hour (WSCH) for Classrooms Among the Surveyed States with Classroom Standards in the Community College Prototype



Source: Display 26

DISPLAY 28 *Existing and Suggested Classroom Utilization Standards, Based on Fall 1987 California State University Utilization*

	Current Fall 1987 Utilization Pattern				Suggested Utilization Pattern			
	8am-Noon	Noon-5pm	5pm-10pm	Totals	8am-Noon	Noon-5pm	5pm-10pm	Totals
MONDAY								
Hours Available	4	5	5	14	4	5	5	14
Weekly Room Hours	3.270	3.507	2.734	9.511	3.200	3.500	2.500	9.200
Station Occupancy Percentage	84.0%	68.0%	61.4%	72.0%	80.0%	70.0%	60.0%	70.8%
Weekly Station Hours (WSH)	2.750	2.416	1.682	6.848	2.560	2.450	1.500	6.510
WSH % of Current Standard	137.5%	96.6%	67.3%	97.8%	128.0%	98.0%	60.0%	93.0%
TUESDAY								
Hours Available	4	5	5	14	4	5	5	14
Weekly Room Hours	3.196	3.767	2.921	9.884	3.200	3.500	2.500	9.200
Station Occupancy Percentage	82.4%	71.6%	62.7%	71.5%	80.0%	70.0%	60.0%	70.8%
Weekly Station Hours	2.636	2.719	1.831	7.186	2.560	2.450	1.500	6.510
WSH % of Current Standard	131.8%	108.8%	73.2%	102.7%	128.0%	98.0%	60.0%	93.0%
WEDNESDAY								
Hours Available	4	5	5	14	4	5	5	14
Weekly Room Hours	3.253	3.524	2.855	9.[illegible]	3.200	3.500	2.500	9.200
Station Occupancy Percentage	83.8%	67.5%	59.5%	69.3%	80.0%	70.0%	60.0%	70.8%
Weekly Station Hours	2.731	2.411	1.698	6.840	2.560	2.450	1.500	6.510
WSH % of Current Standard	136.6%	96.4%	67.9%	97.7%	128.0%	98.0%	60.0%	93.0%
THURSDAY								
Hours Available	4	5	5	14	4	5	5	14
Weekly Room Hours	3.152	3.674	2.478	9.304	3.200	3.500	2.500	9.200
Station Occupancy Percentage	82.2%	71.4%	60.2%	70.5%	80.0%	70.0%	60.0%	70.8%
Weekly Station Hours	2.594	2.647	1.494	6.735	2.560	2.450	1.500	6.510
WSH % of Current Standard	129.7%	105.9%	59.8%	96.2%	128.0%	98.0%	60.0%	93.0%
FRIDAY								
Hours Available	4	5	5	14	4	5	5	14
Weekly Room Hours	2.907	1.825	0.054	4.786	3.200	2.000	0.000	5.200
Station Occupancy Percentage	82.7%	64.8%	41.8%	61.7%	80.0%	70.0%	0.0%	76.2%
Weekly Station Hours	2.413	1.259	0.025	3.697	2.560	1.400	0.000	3.960
WSH % of Current Standard	120.7%	50.4%	1.0%	52.8%	128.0%	56.0%	0.0%	56.6%
TOTAL								
Hours Available	20	25	25	70	20	25	25	70
Weekly Room Hours	15.778	16.297	11.042	43.117	16.000	16.000	10.000	42.000
Station Occupancy Percentage	83.0%	68.7%	57.1%	68.6%	80.0%	70.0%	48.0%	71.4%
Weekly Station Hours	13.124	11.452	6.730	31.306	12.800	11.200	6.000	30.000
WSH % of Current Standard	131.2%	91.6%	53.8%	89.4%	128.0%	89.6%	48.0%	85.7%

Source: California State University, 1988; and CPEC staff analysis.

data from the University of California, and the anecdotal comments generated from the community college focus groups, morning room-hour utilization often exceeds the existing standard by a wide margin, while afternoon utilization tends to be slightly below the standard, with major fall-offs after 2 or 3 p.m. Evening utilization in the State University and the community colleges is generally below the standard, but is insignificant at the University of California, except for University Extension activity.

- Second, station occupancy percentages tend to be highest in the morning, less in the afternoon, and less still in the evening.
- Third, utilization falls to very low levels on Friday afternoon, and is virtually nonexistent on Friday evening.

By comparing the assumptions underlying the 35-hour standard established by the Legislature in 1970, and the 30-hour standard proposed here, it can be seen that the differences are not as great as might at first be thought. The five-weekly-station-hour difference is drawn primarily from two sources -- the elimination of Friday evenings as a component of the standard, which eliminates 2.5 hours of usage, and the slightly lower expectations for Friday afternoon and all of the evenings, which produces the other 2.5 hours.

As noted earlier, the existing California classroom standard is composed of four components: weekly room hours, station occupancy percentage, weekly station hours, and assignable square feet per station. In the national survey, MGT gathered data on all of these indices, and found that California's standard of 15 assignable square feet per student station tended to be somewhat lower than the rest of the nation. Display 29 recreates the data developed by MGT for this one element of the standard, and while some states use the same 15 assignable square feet standard as California, others, such as the Florida Community Colleges, have gone as high as 25.

The argument for differential assignable square feet/station standards -- those that vary by the type of lecture space being constructed -- stems largely from the fact that large classrooms require less square feet per station than small ones. An example of this was illustrated in *Time and Territory*, which showed design guidelines for lecture spaces in Texas that started as low as 8.2 to 8.6 assignable square feet/station for large lecture halls, to 20 assignable square feet/station for seminar or conference rooms. From this example, it can be seen that when a campus has a significant number of auditoria or large lecture halls, its space needs tend to be reduced. At present, the University of California's lecture areas average closer to 14 assignable square feet/station than 15, while the State University's average, with its preponderance of smaller classrooms, is 15.8. Comparable figures for the community colleges are not available, but if the pattern holds true, it is probable that the assignable square feet/station in that segment also exceeds 15, and quite probably should.

In spite of this, ten of the 17 states shown in Display 29 (including Ontario) have opted for a single assignable square feet/station standard, and if the basic philosophy of the space standards project is maintained -- that space standards should be kept as simple as possible and should not become design standards -- it may still be advisable to use a single number for all three segments. Arguably, this gives the University of California an advantage, but when it is considered that the University has virtually no evening program, and therefore may not be able to meet the utilization standard, a single standard for both assignable square feet/station and utilization may still be appropriate. Without doubt, such suitability would not obtain if the standards are used as design criteria, but if plans are closely geared to needs, and exceptions made in appropriate and well-justified circumstances, the single-number approach should work better than variable standards that need constant adjustment.

The final element of the classroom standard is support space, which is currently expressed as a percentage of classroom assignable square feet arrayed by discipline. Volume II of MGT's national survey contains several tables indicating how this space is assigned, and at present, it produces an additional 7.1 percent for the University of California and 7.7 percent for the State University, with no allowance for the community colleges. It is proposed, principally for reasons noted in the next paragraph, that 10 percent be added for all three segments. This would not represent a change in many disciplinary categories, but it would have the effect of increasing total space by a few percentage points.

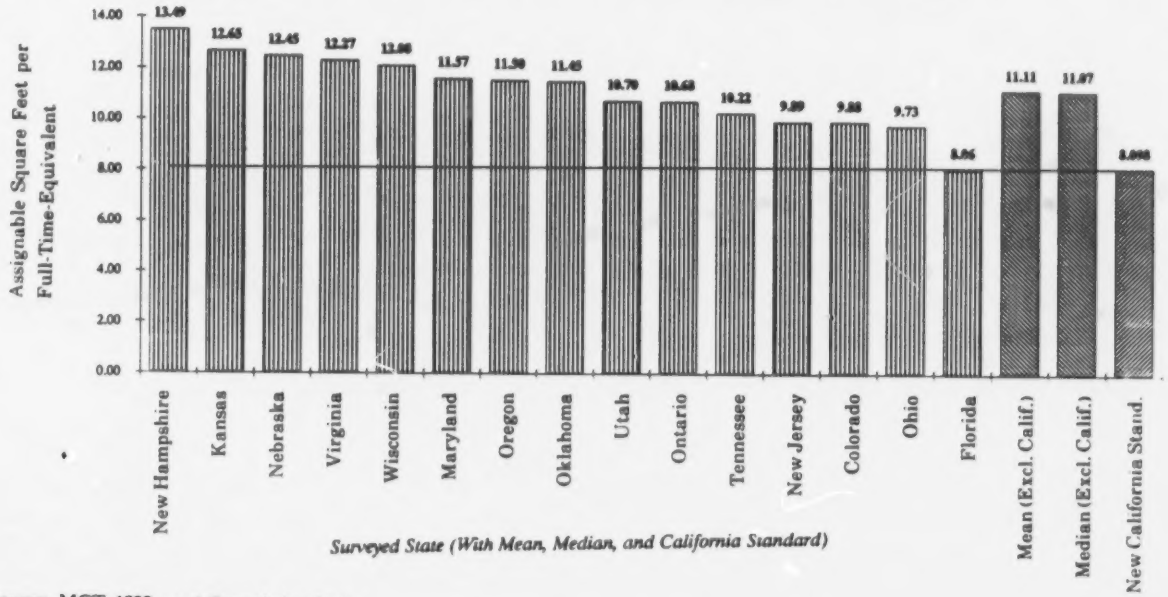
In the focus groups, a consistent complaint was the lack of support space in virtually every space cate-

DISPLAY 29 *Assignable Square Feet per Student Station Standards Among the Surveyed States in the MGT National Survey*

State and Institutional Type	Assignable Square Feet per Station	State and Institutional Type	Assignable Square Feet per Station
California		Oklahoma	16.0
Community Colleges	15.0	Oregon	15.0
California State University	15.0	Tennessee	15.0
University of California	15.0	Utah	
Colorado	15.0	University	16.0
Florida		Masters Degree/4 yr. Institution	16.5
Community Colleges	25.0	Community Colleges	17.0
Universities	22.0	Virginia	
Kansas	15.0	Two-Year Institutions	
Maryland		< 2,500 Enrollment	16.0
Universities	17.6	≥ 2,500 Enrollment	15.0
Community Colleges	16.3	Comprehensive Colleges	
Nebraska	16.0	< 2,500 Enrollment	16.0
New Hampshire	16.0	≥ 2,500 Enrollment	15.0
New Jersey	16.0	Doctoral Granting Institutions	15.0
New York		Washington	
CUNY		Community Colleges	
Typical Classroom	16.0	< 1,000 Enrollment	N/A
Large Lecture Halls	12.0	≥ 1,000 Enrollment	18.0
Ohio		Wisconsin	16.0
Two-Year Colleges		Ontario, Canada	15.0
Technical Colleges	18.0		

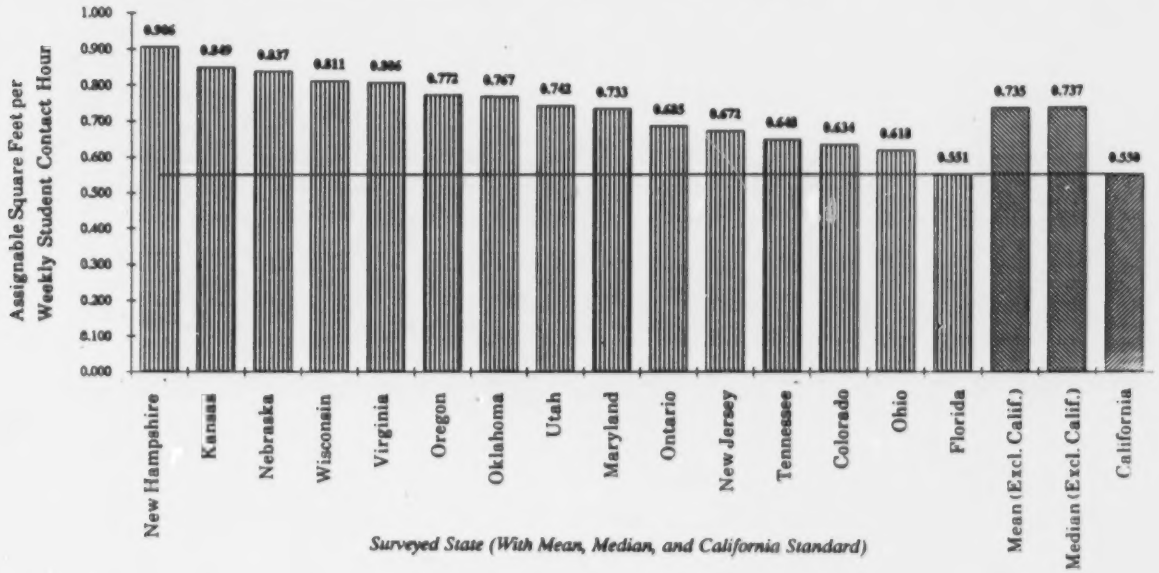
Source: MGT, 1989a

DISPLAY 30 *Comparison of New California Classroom Standards With Standards in the Surveyed States for the Research University Prototype -- Lower Division*



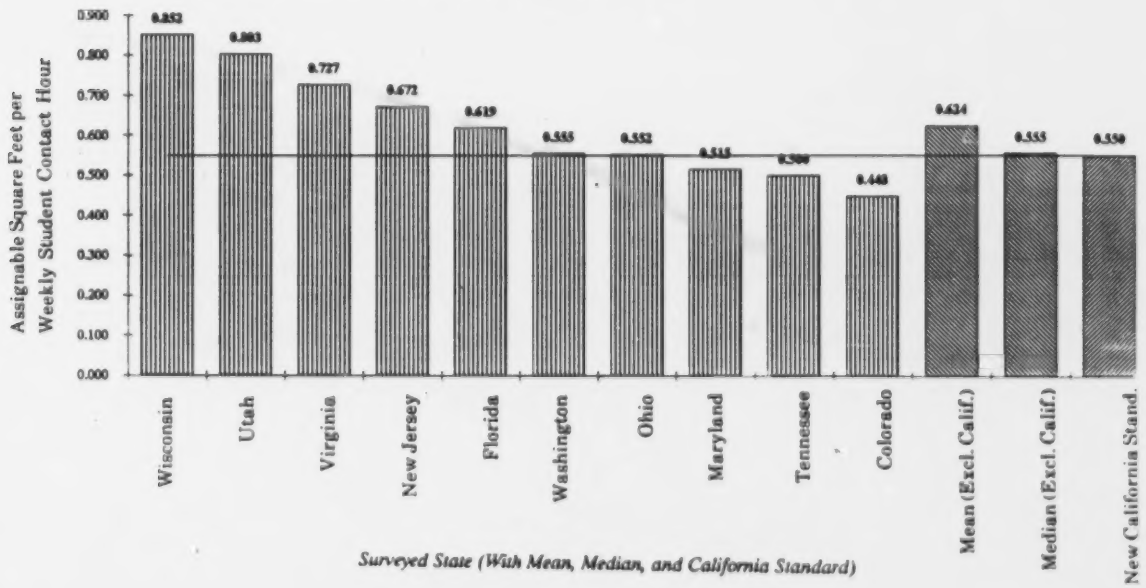
Source: MGT, 1989a; and Commission Staff

DISPLAY 31 *Comparison of New California Classroom Standards with Standards in the Surveyed States for the State University Prototype -- Lower Division*



Source: MGT, 1989a; and Commission Staff

DISPLAY 32 *Comparison of New California Classroom Standards with Standards in the Surveyed States for the Community College Prototype*



Source: MGT, 1989a; and Commission Staff

gory, including classrooms. MGT commented on this fact at some length in its final report, noting that "Substantial increases in the use of film, video tape, in-class demonstrations, and interactive computer instruction have increased the need for media support space" (MGT, 1989c, p. 37). Within the individual focus-group discussions, this theme was mentioned repeatedly, with faculty in most disciplines commenting on the need for storage areas, not only for electronic and video equipment, but also for art supplies, chemicals, other hazardous materials, set-up areas, and security.

Displays 30 through 32 on the two previous pages show the effect of the suggested new standards in comparison to the national data, with only lower division shown; the comparison for higher levels of instruction is similar. It is proposed that the 15 assignable square feet/station standard remain unchanged, but that a 10 percent allowance for support/storage areas be applied to the standard in each of the segments. Concerning the utilization standard, an alteration is proposed from the current formula of 53 weekly room hours at 66 percent utilization, to a room hour expectation of 42 hours, with a higher station occupancy percentage of 71.4 percent. The station occupancy percentage figure may appear a little artificial in comparison to the 66 percent figure currently in use, but it has the usefulness of producing the suggested weekly station hour figure of 30. In sum, the new formula is as follows:

$$\frac{15 \text{ ASF/Station}}{42 \text{ WRH} \times 71.4\% \text{ SOP}} = .500 + 10\% = .550 \text{ ASF/WSCH}$$

5 *Teaching Laboratories*

THE 1955 *Restudy* explored as much of the history of utilization standards as possible, and discovered that the utilization of both classrooms and teaching laboratories was extremely low prior to World War II, often encompassing only the morning hours, with a strong bias towards class meetings on Monday, Wednesday, and Friday. At the time, the *Restudy* team was convinced that much greater utilization could be achieved, and even though its conclusions regarding classrooms seem somewhat conservative today, its teaching laboratory standards were far more realistic by current standards: 24 weekly room hours at 80 percent utilization at both the lower- and upper-division levels. In proposing this new standard, the *Restudy* team offered a number of caveats that are excerpted below (McConnell, pp. 322-323).

> It is obvious, of course, that an institution whose enrollment is appreciably below its capacity will not have the student body to attain these standards. However, they (the standards) should be used as a basis for determining first of all the present capacity of the physical plants and on that basis to project future plant needs based on estimated enrollments.
>
> Utilization of present laboratory space is limited by a number of physical, as well as academic factors. It may be that some present facilities, in the University and the state colleges for structural or other reasons, cannot be satisfactorily converted. This may mean that the Restudy standards cannot be met for particular buildings or laboratories and that this must either be accepted or that the space must be replaced by more adequate facilities.
>
> A standard expressed as an average percentage of utilization cannot be applied inflexibly to all laboratories, because their degree of utilization is determined by different academic factors and will vary from laboratory to laboratory.

The *Restudy* team also offered teaching laboratory floor area standards for the first time, but did so in a somewhat imprecise manner. Display 33 on page 62 shows those standards, arrayed for nine discipline categories in the California State Colleges and the University of California on the basis of assignable square feet per full-time-equivalent student. No comparable standards were proposed for the junior colleges at that time.

The use of assignable square feet/full-time-equivalent student required the application of specified student/faculty ratio assumptions. At the University of California, these were taken to be 30/1 for lower division, 20/1 for upper division, and 10/1 for the graduate level. In the State Colleges, conversions were applied based on the number of contact hours necessary to generate a credit hour, with credit hours then computed into full-time equivalents. These generally ranged from a 2/1 to a 3/1 ratio in teaching laboratories, depending on the discipline. Such an approach tended to produce approximations rather than precision.

In 1966, the Coordinating Council recommended major changes in this approach, arguing that utilization should be based on a new formula founded on weekly student contact hours (WSCH) by level of instruction, and space-per-station standards arrayed both by discipline and by level of instruction. That approach produced the now familiar "space factor" formulas and space-per-station allowances shown in Displays 34 and 35 on pages 63 and 64.

There is little question that the Council's move to weekly student contact hours as a basic unit of measurement was sound, since it obviated the need for student-faculty ratios or credit-hour conversions, either or both of which may lose accuracy over time. The change to specific, published assignable square feet/station standards was also an improvement in that it permitted greater clarity in space allocations by discipline. These allocations did not, however, remain static, as a number of agreements between the segments and the Department of Finance indicate. The 1966 Coordinating Council space-per-station standards are compared with the current standards as reported by MGT in Displays 36, 37, and 38 on pages 65-67.

DISPLAY 33 – Standard Instructional Floor Areas per Student Recommended for Teaching Laboratories for the State Colleges and the University of California by the 1955 Restudy of the Needs of California in Higher Education

Assignable Square Feet per Full-Time-Equivalent Student

Discipline	Level of Instruction	Segment: State Colleges	Segment: University of California
Agriculture	Lower	41	41
	Upper	63	63
	Graduate	100	--[1]
Arts and Crafts	Lower	36	36
	Upper	53	53
	Graduate	60	--
Engineering	Lower	95	95
	Upper	96	96
	Graduate	--	--[1]
Languages and Literature	Lower	--[2]	--[2]
	Upper	--[2]	--[2]
	Graduate	--[2]	--[1]
Mathematics	Lower	--[2]	--[2]
	Upper	--[2]	--[2]
	Graduate	15[2]	--[1]
Misc. Professions[3]	Lower	31	31
	Upper	2	2
	Graduate	30	30
Biological Sciences	Lower	30	30
	Upper	38	38
	Graduate	60	--[1]
Physical Sciences	Lower	28	28
	Upper	42	42
	Graduate	80	--[1]
Social Sciences	Lower	3	3
	Upper	2	2
	Graduate	15	--[1]

1. Allowance included under research laboratories
2. Allowance included in classroom area
3. Education, journalism, law, librarianship, social welfare

Source: McConnell, 1955, p. 345.

Another of the Coordinating Council's recommendations was to create different utilization standards for lower- and upper-division laboratories. It did so on the basis of Fall 1963 data that indicated substantial differences between utilization in lower division labs versus utilization in all laboratories, as shown in Display 39 on page 68. No data were collected specifically for upper-division laboratories.

DISPLAY 34 Space Factor Formulas for Teaching Laboratories in the Three California Public Segments, 1966

Formula for deriving the standards:

$$\frac{\text{Assignable Square Feet per Station (ASF)}}{\text{Hours per Week X Station Occup. Percentage}} \times 100 = \text{ASF/100 WSCH}$$

Lower Division Formula (biological sciences):

$$\frac{55^1}{25 \times .85} \times 100 = 260 \text{ ASF/100 WSCH}$$

Upper Division Formula (Social Sciences):

$$\frac{60^1}{20 \times .80} \times 100 = 375 \text{ ASF/100 WSCH}$$

1. Display 36

In most cases, these data indicated substantial divergences between the two levels, which led the Council to conclude that differential standards were appropriate. They consequently proposed the utilization standards shown in Display 34, which called for utilization rates of 21.25 weekly station hours for lower-division laboratories (25 weekly room hours with an 85 percent station-occupancy percentage), and 16.0 hours for upper-division laboratories (20 weekly room hours with an 80 percent station-occupancy percentage) -- a difference of 5.25 hours. Given the range between lower-division and all laboratories of about three hours, the 5.25 difference was probably greater than necessary.

Evidence accumulated subsequently indicates that the utilization differences between lower- and upper-division teaching laboratories are not as great as the Council thought. This is shown by the data in Display 40 and the discussion in the next section.

As noted in Part Two, the late 1960s saw a considerable increase in legislative interest in utilization questions -- an interest that led to the passage of Assembly Concurrent Resolution 151 regarding classrooms in 1970 and the subsequent adoption of Supplemental Budget Language in 1973 that increased the lower-division teaching laboratory utilization standard from 25 to 27.5 weekly room hours and the upper-division standard from 20 to 22. Station occupancy percentages were unaffected, as were the various space-per-station allowances. These standards, of course, have remained in effect ever since.

Teaching laboratory utilization trends

The only reliable teaching laboratory utilization data come from the California State University's annual report on the subject, which has an eighteen-year history. Display 40 on page 68 shows the data from various years between Fall 1969, when the Coordinating Council made the first study that distinguished between lower- and upper-division levels, and Fall 1987. As noted previously, the 1963 study looked only at lower division and all laboratories. Given the data in Display 40, it seems plausible either that the 1963 data were flawed or that laboratory utilization patterns were undergoing a substantial change. The Fall 1969 data seem somewhat anomalous in contrast to other years, but since 1973 a relatively clear pattern emerges that

DISPLAY 35 Assignable Square Feet Per Station and Per 100 Weekly Student Contact Hour Teaching Laboratory Standards, 8 a.m. - 5 p.m., in California's Public Segments of Higher Education, 1966

Discipline and Level of Instruction	ASF/ Station	ASF/ 100 WSCH
Life Sciences		
Agriculture		
Lower Division	60	280
Upper Division	60	375
Biological Sciences		
Lower Division	55	260
Upper Division	60	375
MPE[1] Sciences		
Physical Sciences		
Lower Division	60	280
Upper Division	70	440
Mathematical		
Lower Division	30	140
Upper Division	30	190
Engineering Sciences		
Lower Division	90	425
Upper Division	110	690
Social Sciences		
Psychology		
Lower Division	40	190
Upper Division	60	375
All other social sciences		
Lower Division	30	140
Upper Division	30	190
Humanities		
Art		
Lower Division	65	305
Upper Division	65	405
Other humanities		
Lower Division	40	190
Upper Division	40	250
Professions (UC & CSC)		
Business		
Lower Division	30	140
Upper Division	30	190
Education		
Lower Division	–	—
Upper Division	40	250
Home Economics		
Lower Division	60	280
Upper Division	60	375
Journalism		
Lower Division	60	280
Upper Division	60	375
Health Sciences		
Lower Division	–	—
Upper Division	50	315
Junior College Classifications		
Agriculture	150	705
Business	30	140
Home Economics	60	280
Applied Graphic Arts	80	375
Health Services	50	235
Public Personnel Services	50	235
Aeronautical Technology	175	820
Air Conditioning	130	610
Building Trades	175	820
Ceramic Technology	40	190
Chemical Technology	70	330
Drafting Technology	60	280
Electrical Technology	70	330
Electromechanical	100	470
Electronic Technology	60	280
Engineering, General	90	425
Engineering Technology	70	330
Industrial Technology	75	350
Mechanical - Automobile	200	940
Metallurgical Technology	65	305
Metal Trades	130	610
Textile Technology	120	565
Welding	90	425
Other Trade Technology	75	352

1. Mathematics, Physical Sciences, and Engineering

Source: CCHE, 1966, page 8

DISPLAY 36 Comparison of 1966 and 1989 California Community College Teaching Laboratory Standards

Discipline	1989 ASF/Station	1966 CCHE ASF/Station	Discipline	1989 ASF/Station	1966 CCHE ASF/Station
Agriculture	115	150	Glazing	175	—
Air Conditioning	130	130	Graphic Arts	80	80
Architecture	60	—	Health Services	50	50
Drafting Technology	—	60	Heavy Equipment	200	—
Mechanical - Automobile	—	200	Home Economics	60	60
Auto-Body & Fender	200	—	Interdisciplinary	60	—
Auto-Mechanic	200	—	Letters	35	—
Auto-Technology	75	—	Library Science	35	—
Aeronautical Technology	—	175	Machine Tools	90	—
Aviation Maintenance	175	—	Masonry	175	—
Biological Sciences	55	55	Mathematics	35	30
Business and Management	30	30	Metallurgical Technology	—	65
Building Trades	—	175	Metal Trades	90	130
Carpentry	175	—	Millwork	90	—
Ceramic Technology	—	40	Painting	175	—
Chemical Technology	—	70	Physical Sciences	60	60
Commercial Services	50	—	Plastering	175	—
Communications	50	—	Plastics	130	—
Computer & Information Sciences	40	—	Plumbing	175	—
Diesel	200	—	Psychology	35	40
Dry-Wall	175	—	Public Personnel Services	—	50
Education	75	—	Public Affairs & Services	50	—
Electrical Technology	—	70	Refrigeration	130	—
Electromechanical	—	100	Roofing	175	—
Electronic Technology	—	60	Small Engine Repair	100	—
Industrial Technology	—	75	Social Sciences	35	30
Electricity	175	—	Stationary Engineering	200	—
Engineering	75	90	Textile Technology	—	120
Engineering Technology	—	60	Welding	90	90
Fine & Applied Arts	60	65	Other Trade Technology	—	75
Foreign Language	35	—			

Sources: MGT, 1989b; and CCHE, 1966, page 8

DISPLAY 37 Comparison of 1966 and 1989 California State University Teaching Laboratory Standards

Discipline	Lower Division ASF/Station[1] 1989	Lower Division ASF/Station[1] 1966 CCHE	Upper Division ASF/Station[1] 1989	Upper Division ASF/Station[1] 1966 CCHE
Agriculture	60.0	60.0	60.0	60.0
Anthropology	42.5	–	45.0	–
Architecture	68.0	–	82.7	–
Area Studies	30.0	–	30.0	–
Art	65.0	65.0	65.0	65.0
Biological Science	55.0	55.0	60.0	60.0
Broadcast Communication Arts	30.0	–	60.0	–
Business Administration and Economics	30.0	30.0	30.0	30.0
Communications	30.0	–	30.0	–
Computer Science	49.0	–	49.0	–
Education	40.0	–	40.0	–
Engineering, CAD/CAM	86.0	–	86.0	–
Engineering, other	90.0	90.0	110.0	110.0
Fine Arts	60.0	–	80.0	–
Foreign Languages	40.0	–	40.0	–
Geography	42.5	–	45.0	–
Health Professions	40.0	–	50.0	–
Health Science	40.0	–	50.5	–
Home Economics	60.0	60.0	60.0	60.0
Humanities, general	40.0	40.0	40.0	40.0
Industrial Arts	68.0	–	82.7	–
Journalism	60.0	60.0	60.0	60.0
Mathematics	30.0	30.0	30.0	30.0
Physical Science	60.0	60.0	70.0	70.0
Psychology	40.0	40.0	60.0	60.0
Public Administration	30.0	–	30.0	–
Social Sciences, general	30.0	30.0	30.0	30.0

1. Excluding storage allowances.

Sources: MGT, 1989b; and CCHE, 1966, page 8.

indicates not only a decrease in lower-division laboratory utilization -- invariably below the legislative standard of 23.4 weekly station hours -- but also a gradual convergence between lower- and upper-division utilization rates, with the difference between the two standing at only 1.006 as of Fall 1987. Upper-division laboratory utilization has changed little in the past two decades, and it seems clear that the State University has had no difficulty meeting the legislative standard of 17.6 station hours per week.

An examination of utilization patterns in the State University reveals some similarities to, and some differences from, the classroom pattern discussed in Part Four. Displays 41 through 47 present various arrays of the State University's Fall 1987 data for both lower- and upper-division teaching laboratories. These displays show weekly room hours, station occupancy percentages, and weekly station hours by time of day and day of the week for the system as a whole, then compare station-hour utilization to the lower- and upper-division standards for each campus in the system.

These displays indicate a similar utilization pattern to classrooms, with strong utilization during the 8 a.m. - 5 p.m. period but a considerable falloff during

DISPLAY 38 Comparison of 1966 and 1989 University of California Teaching Laboratory Standards

Discipline	Lower Division ASF/Station[1] 1989	Lower Division ASF/Station[1] 1966 CCHE	Upper Division ASF/Station[1] 1989	Upper Division ASF/Station[1] 1966 CCHE
Administration	33	–	33	–
Agricultural Biological Sciences	58	–	60	–
Agricultural Economics	33	–	33	–
Agricultural Science	60	60	60	60
Anthropology	43	–	45	–
Architecture (Environmental Design)	65	–	65	–
Arts, Performing	65	–	65	–
Arts, Visual	65	65	65	65
Biological Sciences	55	55	60	60
Business	–	30	–	30
Computer Science	45	–	55	–
Education	40	–	40	40
Engineering Sciences	90	90	110	110
Engineering, Agriculture	90	–	110	–
Engineering, Chemical	75	–	90	–
Foreign Languages	40	–	40	–
Geography	45	–	50	–
Health Sciences	–	–	–	50
Home Economics	–	60	–	60
Humanities, other	–	40	–	40
International Relations	40	–	40	–
Journalism	40	60	40	60
Law	40	–	40	–
Letters	40	–	40	–
Library Science	40	–	40	–
Mathematical Sciences	30	30	30	30
Physical Science	60	60	70	70
Psychology	43	40	45	60
Social Ecology	45	–	45	–
Social Sciences, general	30	30	30	30
Social Welfare	30	–	30	–
Speech	48	–	50	–
Studies, Applied Behavioral	40	–	40	–
Studies, Creative	40	–	40	–
Studies, Environmental	55	–	60	–
Studies, Interdisciplinary	30	–	30	–

1. Excluding storage allowances.

Sources: MGT, 1989b; and CCHE, 1966, page 8.

the evening and on Fridays. Unlike classrooms, however, laboratories undergo a considerable reduction in usage at midday, which is undoubtedly caused by the fact that most laboratory sections are scheduled in three-hour blocks and consequently cannot be used as flexibly as classrooms.

From Display 47, it can also be seen that there is a great divergence among the campuses in utilization rates. Part of this probably results from differences in how laboratories are categorized, for there are a number of cases where a campus has seemingly poor utilization for lower-division sections but excellent usage at the upper-division level. Examples of this include Bakersfield, Los Angeles, Northridge, and San Francisco, among others. Conversely, Hayward and Sonoma have excellent lower-

DISPLAY 39 1963 Utilization Study Results, Coordinating Council for Higher Education

California State Colleges

Campus	Weekly Station Hours: Lower Division	Weekly Station Hours: All Laboratories
Cal Poly - Pomona	15.8	14.4
Cal Poly - SLO	16.0	13.5
Chico	23.7	18.0
Fresno	18.0	13.6
Fullerton	6.1	4.9
Hayward	10.3	7.4
Humboldt	12.4	12.5
Long Beach	11.6	10.0
Los Angeles	11.4	13.1
Sacramento	13.3	14.0
San Diego	18.0	13.4
San Fernando	12.5	9.5
San Francisco	23.4	18.2
San Jose	24.4	17.0
Sonoma	N/A	N/A
Stanislaus	N/A	N/A
All Campuses	15.8	13.2

University of California

Campus	Weekly Station Hours: Lower Division	Weekly Station Hours: All Laboratories
Berkeley	17.9	13.6
Los Angeles	11.1	9.9
Davis	18.1	13.0
Riverside	12.3	9.4
Santa Barbara	16.9	12.5
San Diego	N/A	N/A
All Campuses	15.4	12.1

Sources: CCHE, 1965

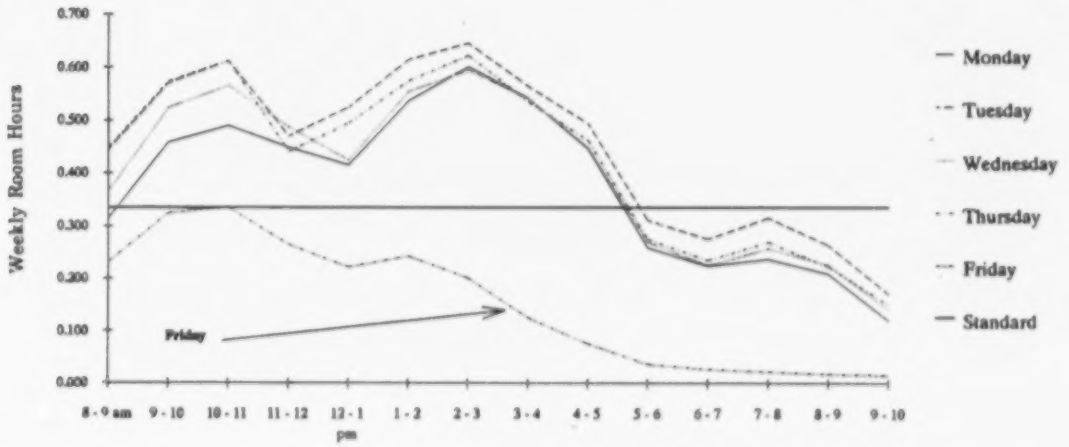
DISPLAY 40 Weekly Station Hours for Teaching Laboratories in the California State University, Selected Years from Fall 1969 to 1987

Year	Lower Division	Upper Division	Lower Division Exceeds Upper Division by:
Fall 1969	20.3	19.6	0.7
Fall 1973	22.767	19.647	3.120
Fall 1976	23.004	20.659	2.345
Fall 1979	22.556	19.810	2.746
Fall 1983	22.036	19.328	2.708
Fall 1984	20.738	18.541	2.197
Fall 1987	21.167	20.161	1.006

Sources: CCHE, 1969; and California State University, 1974, 1977, 1981, 1985, 1986a, and 1988

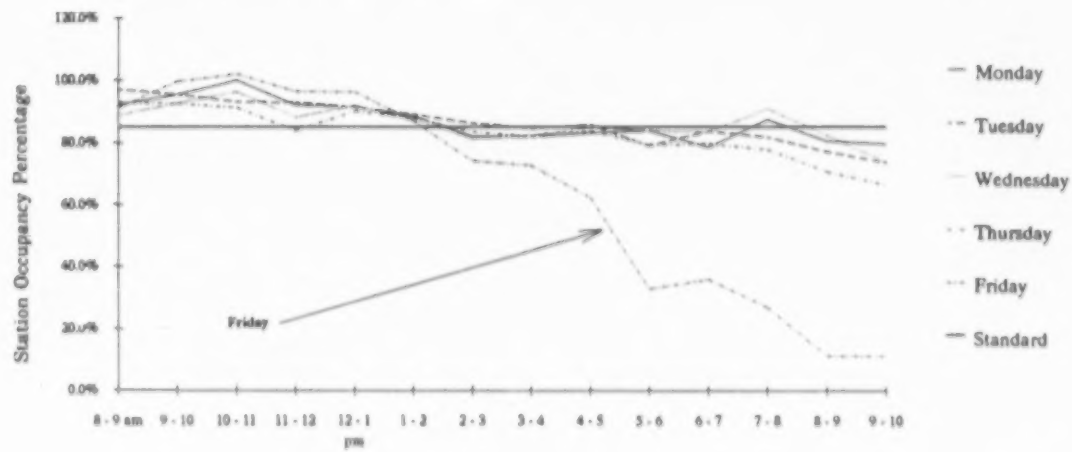
division usage but lower than average utilization at the upper-division level. Another reason may be that certain laboratories are dedicated to specific research projects, are not scheduled for regular classes, and consequently are not counted in the utilization report. In spite of this, and again unlike the circumstances surrounding classroom utilization, the State University usually satisfies the State standards overall -- and does so by exceeding the upper-division standard even as it falls below the lower-division requirement. This represents a considerable departure from classroom utilization, where California's standards are dramatically more demanding than those in other states, and where its

DISPLAY 41 *Weekly Room Hours for Lower-Division Teaching Laboratories by Time of Day and Day of the Week, The California State University, Fall 1987*



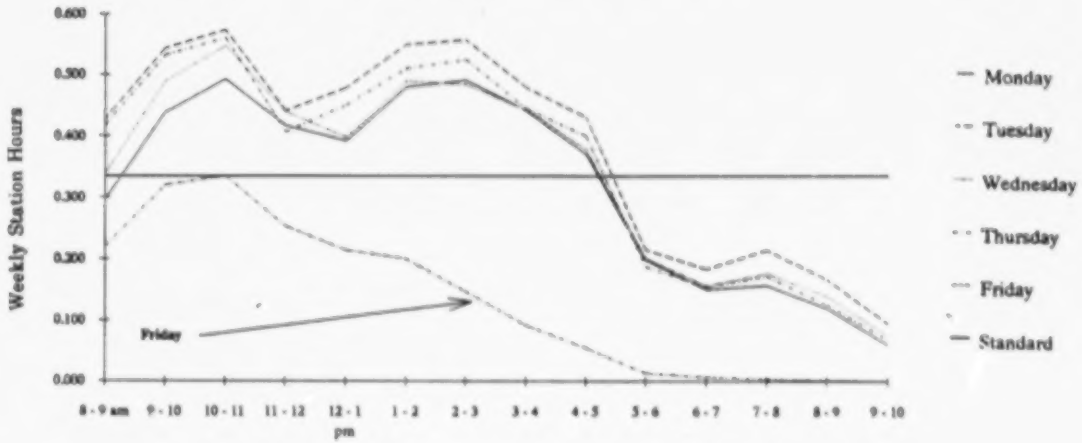
Source: The California State University, 1988.

DISPLAY 42 *Station Occupancy Percentages for Lower-Division Teaching Laboratories by Time of Day and Day of the Week, The California State University, Fall 1987*



Source: The California State University, 1988.

DISPLAY 43 *Weekly Station Hours for Lower-Division Teaching Laboratories by Time of Day and Day of the Week, The California State University, Fall 1987*



Source: The California State University, 1988.

institutions fall considerably short of the existing utilization standard. Given the fact that the State University is currently meeting the laboratory utilization requirements, it should be expected that California's standards should not be as divergent from national practices in the teaching laboratory category as they are for classrooms. This is precisely what the data reveal, as discussed in the next section.

Comparison to national norms

Displays 48 through 57 on pages 74-82 present the results of the MGT national survey for community colleges, regional state universities, and research universities, respectively. Only eight states reported standards for the two-year institutions, while 14 states made data available for their four-year institutions. In each case, the data were arrayed by level of instruction.

For the community colleges, the reporting states used widely varying space-per-station standards. Maryland, Tennessee, Utah, and Wisconsin use only one allowance, Florida and Virginia use two, New Jersey uses six, while Colorado uses 17 different categories, similar to the California four-year segments' total of 14.

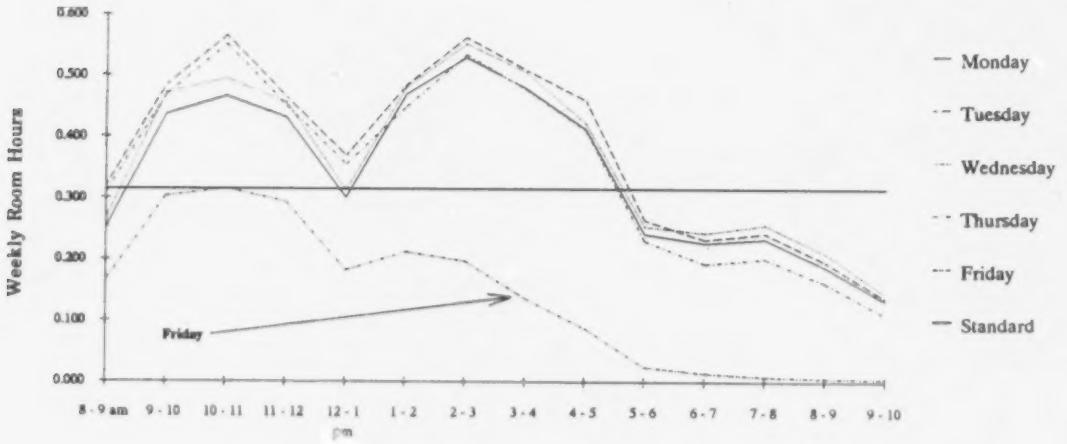
Utilization standards for community colleges also vary from state to state, as shown in Display 54, but tend to cluster around 19 or 20 weekly station hours compared to California's 23.4.

Displays 55 and 56 show utilization standards in other states compared to those in the California State University and the University of California, arrayed by level of instruction where applicable. All the numbers in these two tables are identical with the exception of Virginia, which uses a slightly more liberal utilization standard for its research universities.

In general, the standards reported tend to be less stringent than in California as well as simpler, with only three of the 14 surveyed states using utilization standards differentiated by level of instruction.

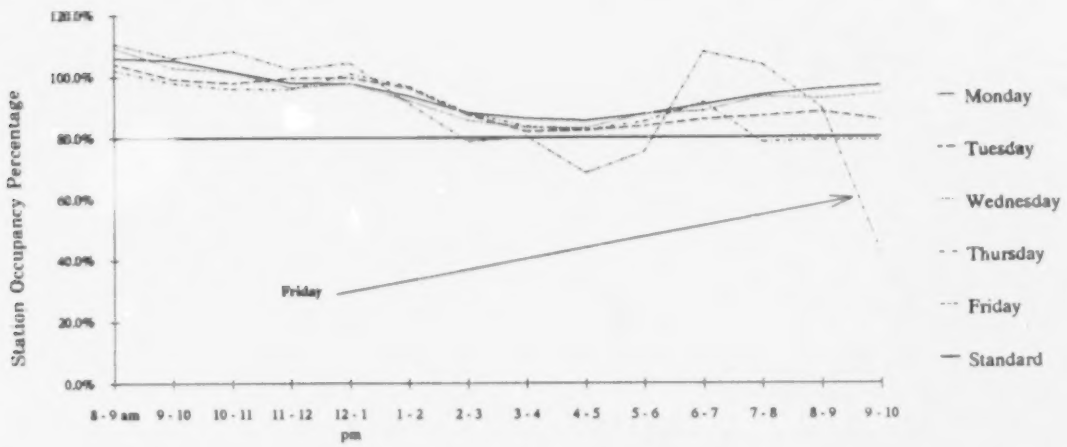
When the national data are normalized to the California prototype institutions, the results indicate that the community colleges fare well in comparison to the eight states where comparisons are possi-

DISPLAY 44 ***Weekly Room Hours for Upper-Division Teaching Laboratories by Time of Day and Day of the Week, The California State University, Fall 1987***



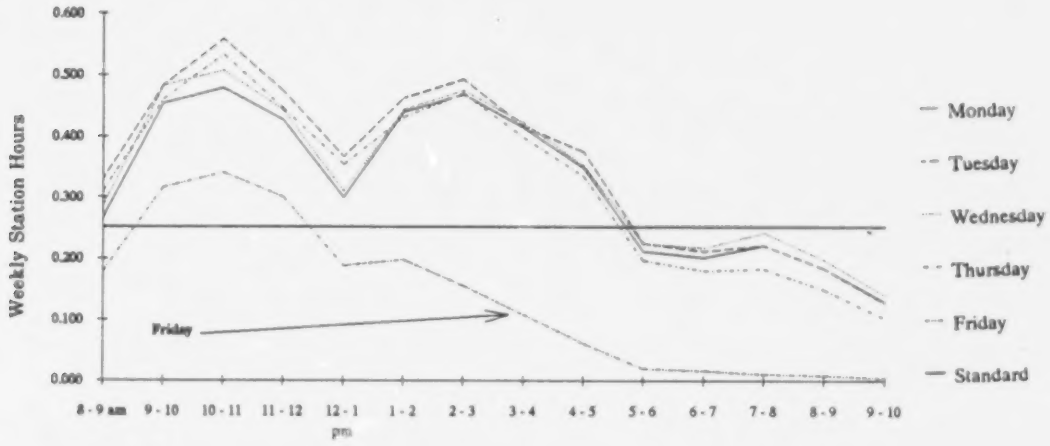
Source: The California State University, 1988.

DISPLAY 45 ***Station Occupancy Percentages for Upper-Division Teaching Laboratories by Time of Day and Day of the Week, The California State University, Fall 1987***



Source: The California State University, 1988.

DISPLAY 46 *Weekly Station Hours for Upper-Division Teaching Laboratories by Time of Day and Day of the Week, The California State University, Fall 1987*



Source: The California State University, 1988.

ble, ranking third out of nine, in spite of the fact that the utilization standard is much stricter than those commonly in use elsewhere. MGT noted this fact in its summary of findings (1989c, p. v):

> Although California utilization requirements for community colleges are higher than utilization guidelines in other states, the California space standards produce a somewhat larger amount of square feet per contact hour than most other states. This appears to be due to the greater emphasis on occupational programs in California community colleges which is reflected in standards that provide the larger amount of space needed to carry out these programs.

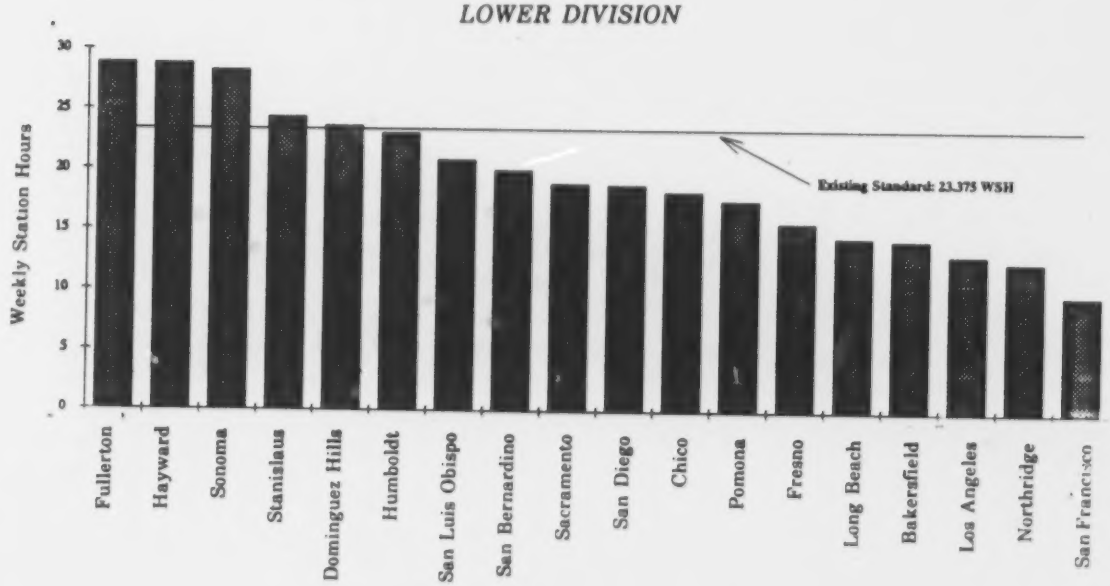
For the four-year institutions, California ranks near the bottom of the surveyed states in terms of the number of square feet generated by its standards. The specific rankings are shown in Display 57, and according to MGT, are caused primarily by California's more stringent utilization standards, particularly at the lower-division level. This is precisely the same phenomenon that was discovered in the analysis of classroom space -- the only difference being that the gap in the utilization standards is considerably less for teaching laboratories than for lecture spaces. As a result, the overall difference in assignable square feet generated per contact hour is also less than for classrooms.

Constructing new teaching laboratory standards

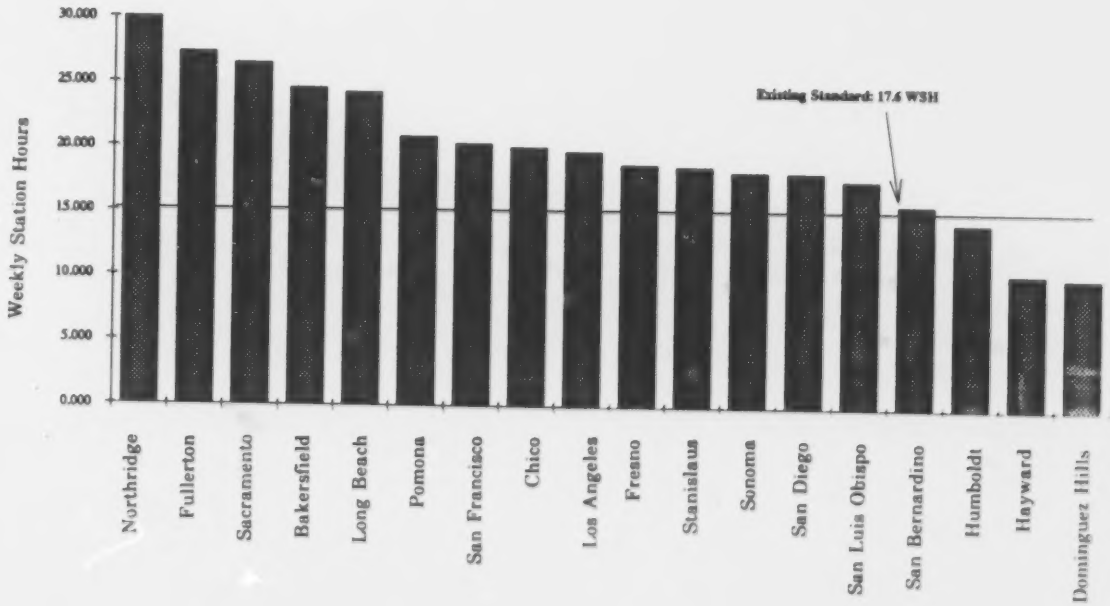
Throughout the Advisory Committee's meetings, its members shared a general consensus that the new classroom and teaching laboratory standards should be less complex than the existing ones, that they should be rigorous in comparison to national norms, and that they should be used as budgetary guidelines that determine campus-wide space limitations, rather than design standards that specify the sizes of individual room types. It was also agreed that appropriate reporting should be required of all three public segments. In considering teaching laboratories, these principles have governed development of the new standards presented below, with the discussion dealing first with space per station standards and second with utilization.

DISPLAY 47 *Weekly-Station-Hour Counts for Teaching Laboratories, The California State University, Fall 1987 -- Lower Division and Upper Division*

LOWER DIVISION



UPPER DIVISION



Source: California State University, 1988.

DISPLAY 48 National Survey Comparisons of Assignable Square Feet per Weekly Student Contact Hour for Teaching Laboratories in the Community College Prototype

State	Normalized Factor
Wisconsin	3.98
Utah	3.63
Florida	2.76
New Jersey	2.41
Virginia	2.37
Maryland	2.20
Tennessee	2.09
Colorado	1.62
Mean (Excl. Calif.)	*2.63*
Median (Excl. Calif.)	*2.41*
California Standard	*2.86*

Source: MGT, 1989a

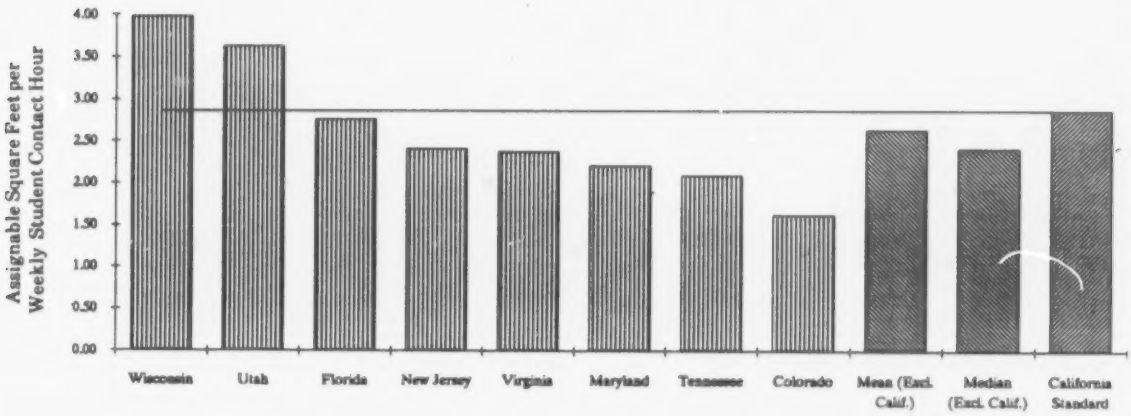
Space per station

The issue of assignable square feet per student station is more complex for teaching laboratories than for most other kinds of academic spaces. Unlike lecture space, which in most cases is generic and can be used by all departments as needed, teaching laboratory space standards must be tailored to the specific needs of various disciplines, which can number in the hundreds. Condensing those disciplines into a manageable array to which assignable-square-feet-per-station standards can be applied has been a major challenge to all of the groups and agencies that have dealt with the subject previously, and each group has reached a different conclusion. In 1955, the *Restudy* team settled on nine groupings for the four-year segments, with no recommendations for the community colleges. In 1966, the Coordinating Council used 14 for the four-year segments and 36 for the community colleges -- the latter including 24 categories of vocational laboratories. In 1988, while developing the taxonomies for the prototype systems used in the national survey, MGT used 32 disciplines for the University of California, 26 for the State University, and 46 for the community colleges. Since the MGT distribution is the most recent of these categorizations, it has been used as a starting point for the recommendations that follow.

In past efforts to develop space standards, the tendency has been to develop standards based on discipline types. For example, in the State University, such fields as anatomy, bacteriology, botany, ecology, marine sciences, entomology, pathology, and zoology, among others, are all grouped for programmatic purposes under the biological sciences, with all of them operating under the same space-per-station standard. Similarly, creative arts, dance, drama, film, music, and photography are all placed within the fine arts category. These groupings provide a degree of planning flexibility, but there now seems to be little question that even greater flexibility can be achieved if disciplines are applied to laboratory types, or at least laboratory sizes, rather than applying the laboratories to the disciplines. In other words, if a few laboratory types ranging from small to large are established, and all of the disciplines inserted into those types, it becomes possible to streamline the process considerably. To be specific, geography and psychology may have very little in common from an academic standpoint, but if both disciplines require teaching laboratories of 50 assignable-square-feet per station, there is no reason not to group them into a single space standard.

Another factor in determining the total space needed for any kind of teaching laboratory is the allowance for service and support areas. Currently, the community colleges have no such allowance, with the four-year segments using percentage adjustments that vary from 5 to 15 percent for each discipline. Such percentages are easily applied when space standards are established for a wide variety of disciplines, but difficulties arise when the standards are organized by laboratory type. For example, the State University currently uses a 5 percent factor for humanities but a 10 percent factor for broadcast communication arts, even though both are proposed for the same space category. To provide flexibility in the administration of the new standards, it is therefore proposed that the service allotment be included in the standards themselves rather than applying a factor (such as 7.5 percent) across the board. This will encourage the tailoring of service areas to specific laboratory needs and discourage the allocation of a service component regardless of need.

DISPLAY 49 *Comparison of Assignable Square Feet (ASF) Per Weekly Student Contact Hour (WSCH) for Teaching Laboratories Among the Surveyed States With Teaching Laboratory Standards in the Community College Prototype*



Source: Display 48.

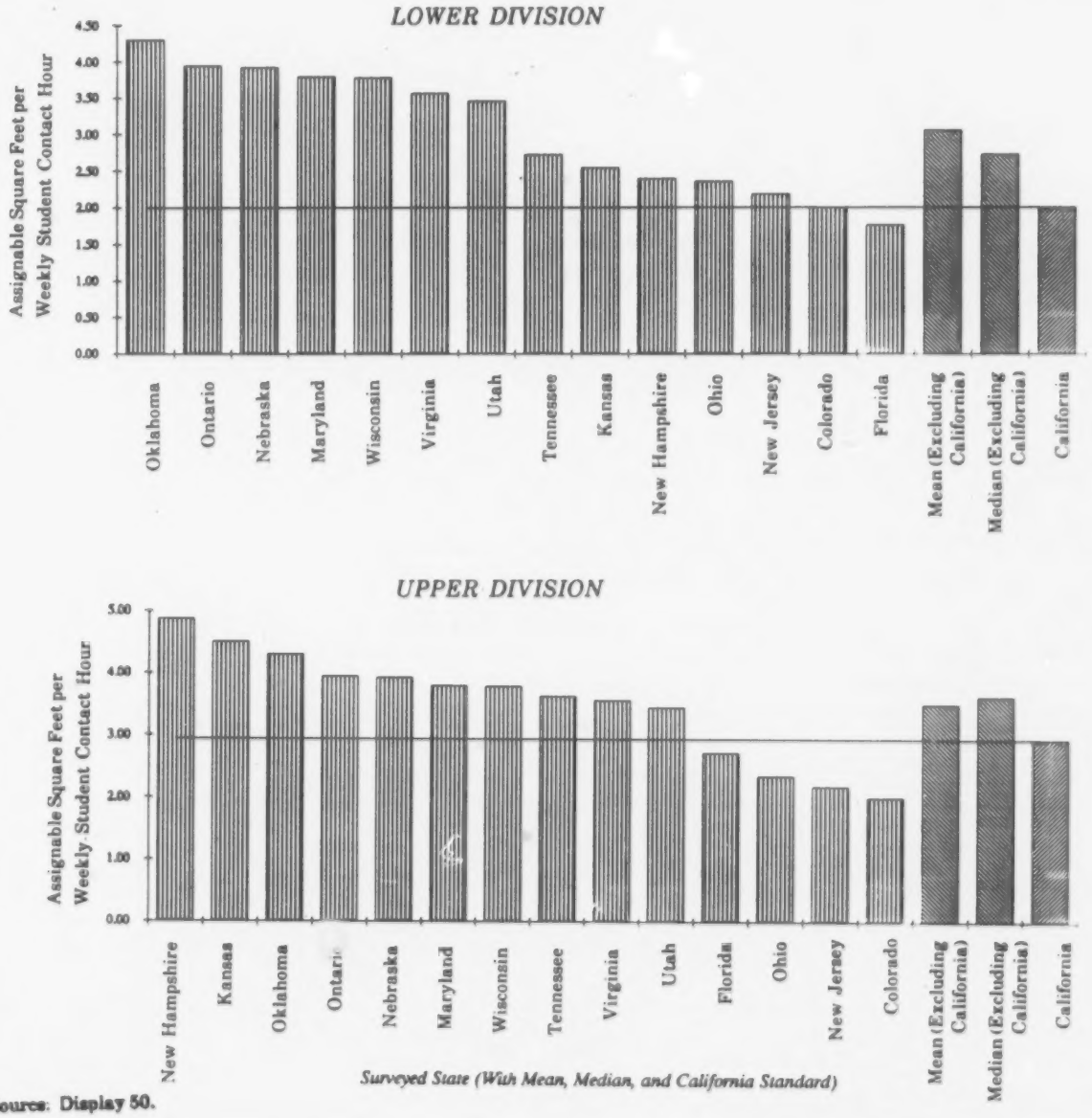
DISPLAY 50 *National Survey Comparisons of Assignable Square Feet per Weekly Student Contact Hour for Teaching Laboratories in the State University Prototype*

Lower Division: State	Normalized Factor	Upper Division:	Normalized Factor	Graduate I:	Normalized Factor
Oklahoma	4.30	New Hampshire	4.87	New Hampshire	4.87
Ontario	3.94	Kansas	4.50	Kansas	4.51
Nebraska	3.92	Oklahoma	4.30	Oklahoma	4.40
Maryland	3.79	Ontario	3.94	Nebraska	3.92
Wisconsin	3.78	Nebraska	3.92	Wisconsin	3.80
Virginia	3.56	Maryland	3.79	Maryland	3.57
Utah	3.45	Wisconsin	3.78	Virginia	3.56
Tennessee	2.72	Tennessee	3.62	Utah	3.46
Kansas	2.54	Virginia	3.56	Tennessee	3.42
New Hampshire	2.39	Utah	3.45	Ohio	2.22
Ohio	2.35	Florida	2.72	New Jersey	2.19
New Jersey	2.18	Ohio	2.35	Florida	2.17
Colorado	2.00	New Jersey	2.18	Colorado	1.88
Florida	1.76	Colorado	2.00	*Mean (Excl. Calif.)*	*3.38*
Mean (Excl. Calif.)	*3.05*	*Mean (Excl. Calif.)*	*3.50*	*Median (Excl. Calif.)*	*3.50*
Median (Excl. Calif.)	*2.72*	*Median (Excl. Calif.)*	*3.62*	*California*	*2.93*
California	*2.00*	*California*	*2.94*		

Source: MGT, 1989a

A final consideration concerns extremely unique facilities in all of the segments. These might include spaces where some instruction occurs, consequently placing them in the "capacity space" category (a type of space where space and/or utilization standards can be applied), but which are so unique that

DISPLAY 51 *Comparison of Assignable Square Feet (ASF) Per Weekly Student Contact Hour (WSCH) for Teaching Laboratories Among the Surveyed States With Teaching Laboratory Standards in the State University Prototype -- Lower Division and Upper Division*



Source: Display 50.

they cannot be regarded as teaching laboratories in the traditional sense. Greenhouses have long been considered spaces of this type, and they are consequently regarded as "non-capacity space." Other types might include wind tunnels, wave flume laboratories, and certain marine science facilities, among others. In most cases, such facilities are built only on rare occasions for a limited number of students, and they do not fit easily into any broadly based laboratory space standard. Given this situation, it

DISPLAY 52 National Survey Comparisons of Assignable Square Feet per Full-Time-Equivalent Student for Teaching Laboratories at the Research University Prototype

Lower Division: State	Normalized Factor	Upper Division:	Normalized Factor	Graduate I:	Normalized Factor
Nebraska	32.53	Kansas	45.45	Kansas	23.61
Oklahoma	31.49	New Hampshire	43.64	New Hampshire	22.60
Ontario	31.48	Nebraska	32.38	Nebraska	18.37
Virginia	26.02	Ontario	29.44	Oklahoma	17.92
Ohio	23.65	Virginia	26.99	Virginia	14.18
Maryland	22.66	Oklahoma	26.33	Ohio	12.89
Wisconsin	21.44	Florida	23.09	Florida	12.89
Kansas	19.54	Ohio	22.59	Maryland	12.71
Utah	19.50	Maryland	21.16	Tennessee	12.15
New Hampshire	19.29	Wisconsin	20.95	Wisconsin	12.03
New Jersey	19.20	Tennessee	20.02	Utah	10.94
Colorado	17.47	Utah	19.04	New Jersey	10.19
Tennessee	16.25	New Jersey	18.67	Colorado	9.20
Florida	13.36	Colorado	16.06	*Mean*	*14.59*
Mean (Excl. Calif.)	*22.42*	*Mean (Excl. Calif.)*	*26.13*	*Median*	*12.89*
Median (Excl. Calif.)	*19.54*	*Median (Excl. Calif.)*	*22.59*	*California*	*N/A*
California	*15.41*	*California*	*21.35*		

Source: MGT, 1989a

seems prudent to incorporate a provision into the new space standards that will permit specialized laboratories to be justified on a case-by-case basis. This is clearly a complex problem, one that prompts the recommendation to study the capacity/non-capacity problem further. In the interim, the new standards should be applied to the existing segmental "capacity space" categorizations.

Utilization

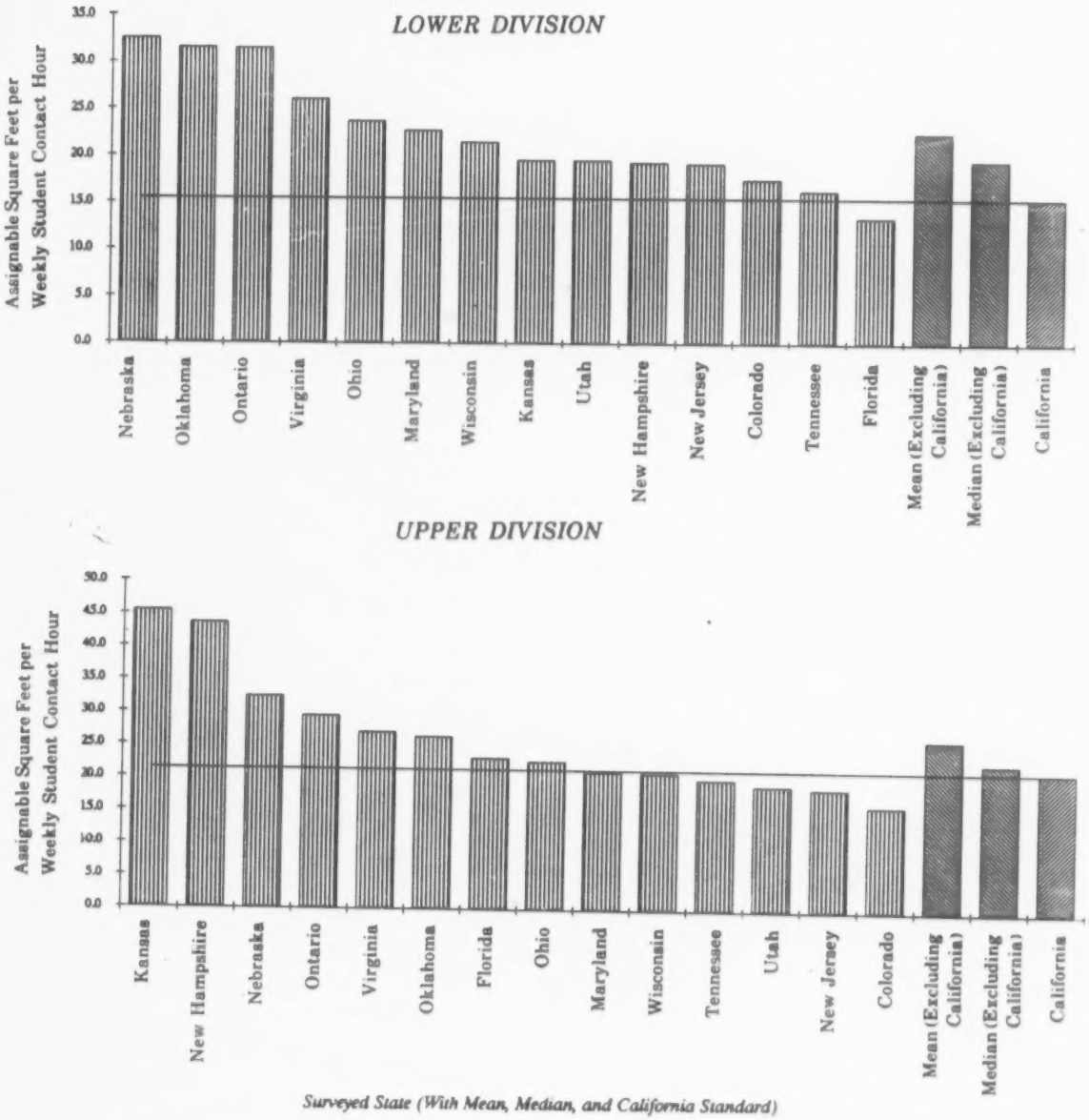
Regarding utilization, it was noted above that the Coordinating Council instituted the practice of differentiating utilization standards by level, and it did so because the available data at the time indicated very divergent usage patterns. Subsequent reports from the State University as well as from the national survey, where 11 of the 14 reporting states were found to use a single standard for both levels, indicate that such a conclusion may have been unwarranted. In addition, differential standards by level may have created an undesirable incentive to build greater numbers of upper-division laboratories, since the space factor formula is heavily influenced by utilization rates and consequently provides far greater space allocations to upper-division laboratories. A single standard for the four-year institutions is therefore proposed that averages the two existing standards. Given the distribution of laboratories in the State University, a weighted utilization standard under the existing requirements would equal about 20 weekly station hours. Such a standard would continue to give California the highest utilization standard in the nation.

The specific proposals for the three segments are shown below.

California Community Colleges

Displays 58 through 60 on pages 83-85 show the teaching laboratory proposal for the California Community Colleges. Display 58 shows the existing disciplinary distribution as reported by MGT, with the current distribution of enrollments, the assignable-square-feet-per-station standards, the space factor (as defined in the footnote), and the weighted average assignable square feet per weekly

DISPLAY 53 ***Comparison of Assignable Square Feet (ASF) per Full-Time-Equivalent Enrollment (FTE) for Teaching Laboratories Among the Surveyed States with Teaching Laboratory Standards at the Research University Prototype -- Lower Division and Upper Division***



Source: Display 52.

student contact hour. Display 59 arrays the 46 disciplines by the 14 existing assignable-square-feet-per-station categories, with the boxed areas showing an approximation of how the disciplines will fit

DISPLAY 54 Teaching Laboratory Utilization Standards for the Community College Prototype

State	Weekly Room Hours	Station Occupancy Percentage	Weekly Station Hours
California	27.5	.85	23.4
Colorado	20.0 or 30.0	.80	16.0 or 24.0
Florida	23.9 or 36.0	.80 or .68	19.1 or 24.5
Maryland	22.9	.798	18.3
New Jersey	24.0	.80	19.2
Tennessee	24.0	.80	19.2
Utah	24.0	.80	19.2
Virginia	29.0	.799	23.2
Wisconsin	24.0	.80	19.2

Source: MGT, 1989a

into the new standards, which range from a low of 33 assignable square feet per station to a high of 185, including service and storage areas. Display 60, in the left column, lists each of the disciplines in the five new assignable-square-feet-per-station categories, with the right section of the display showing the results of a computer model that builds in a new utilization standard of 27 weekly room hours at 80 percent utilization. With the groupings as stated, the net effect is a change of 2.0 percent.

The California State University

Displays 61 through 65 on pages 86-90 how similar arrays for the California State University, beginning in Display 61 with the MGT data from the national survey and then to four displays that contain the new standards. As with the two-year segment, five categories are suggested, and they range from a low of 35 assignable square feet per station to a high of 110, with support space included in each case. The utilization standard is 25 weekly room hours at 80 percent station occupancy for a net weekly station hour standard of 20. To show the overall effect from the existing standards, it is necessary to compute the effects of the changes at each level, then to weight each one by that level's share of the total enrollment. Thus, while the lower-division space per contact hour is increased by 28.5 percent and the upper division and graduate space decreased by 12.0 percent, the latter's far greater share of the total creates a net change of only 1.9 percent -- about the same as for the community colleges.

University of California

It is considerably more difficult to determine the effect of space-per-station standards at the University of California, in part because of the necessity of making conversions to assignable square feet per full-time-equivalent student, but also because the contact hour to full-time-equivalent-student conversion factors used by the University are very old, dating from the time of the 1955 *Restudy*. This is not a problem in the community colleges and the State University, where space factor calculations are based on contact hours. The conversion problem has caused particular difficulties in such disciplines as foreign languages and mathematics, where it is certain that some class laboratory contact hours are generated but where the exact number is unknown. Because reliable data were not available, it was assumed in the original University of California prototype formulation that there were no contact hours in these disciplines, since that was the case in 1955; this had the effect of overstating the average square footages the standards generate, and may well have created distortions in other disciplines where the number of contact hours has changed significantly. In the cases of the "zero contact hour" labs, a factor of three contact hours per full-time-equivalent student has been assigned to bring them into the equation.

DISPLAY 55 Teaching-Laboratory-Utilization Standards for the State University Prototype

State	Weekly Room Hours	Station Occupancy Percentage	Weekly Station Hours
California			
Lower Division	27.5	.85	23.4
Upper Division	22.0	.80	17.6
Colorado	20.0	.80	16.0
Florida			
Lower Division	24.0	.80	19.2
Upper Division	20.0	.80	16.0
Kansas	20.0	.80	16.0
Maryland	21.0	.787	16.5
Nebraska	20.0	.65	13.0
New Hampshire			
Lower Division	24.0	.70	16.8
Upper Division	18.0	.70	12.6
New Jersey	24.0	.80	19.2
Ohio	22.5	.80	18.0
Oklahoma[1]	48.0	.80	38.4
Ontario	18.0	.75	13.5
Tennessee			
Lower Division	24.0	.80	19.2
Upper Division	18.0	.80	14.4
Utah	24.0	.80	19.2
Virginia	25.0	.70	17.5
Wisconsin	24.0	.80	19.2

1. Where minor adjustments are necessary in each of these utilization standards is necessary to achieve normalization, a major adjustment is required for Oklahoma, since the standard applies to an annual utilization total where the others apply to annual averages. The Oklahoma total is consequently about twice as high as it should be to achieve comparability with California and the other states.

Source: MGT, 1989a

DISPLAY 56 Teaching-Laboratory-Utilization Standards for the Research University Prototype

State	Weekly Room Hours	Station Occupancy Percentage	Weekly Station Hours
California			
Lower Division	27.5	.85	23.4
Upper Division	22.0	.80	17.6
Colorado	20.0	.80	16.0
Florida			
Lower Division	24.0	.80	19.2
Upper Division	20.0	.80	16.0
Kansas	20.0	.80	16.0
Maryland	21.0	.787	16.5
Nebraska	20.0	.65	13.0
New Hampshire			
Lower Division	24.0	.70	16.8
Upper Division	18.0	.70	12.6
New Jersey	24.0	.80	19.2
Ohio	22.5	.80	18.0
Oklahoma[1]	48.0	.80	38.4
Ontario	18.0	.75	13.5
Tennessee			
Lower Division	24.0	.80	19.2
Upper Division	18.0	.80	14.4
Utah	24.0	.80	19.2
Virginia	23.0	.70	16.1
Wisconsin	24.0	.80	19.2

1. Where minor adjustments are necessary in each of these utilization standards is necessary to achieve normalization, a major adjustment is required for Oklahoma, since the standard applies to an annual utilization total where the others apply to annual averages. The Oklahoma total is consequently about twice as high as it should be to achieve comparability with California and the other states.

Source: MGT, 1989a

DISPLAY 57 *California's National Ranking in Terms of Assignable Square Feet Generated by Space Standards for Teaching Laboratories, With Percentage Differences From the National Mean*

Segment and Level of Instruction	Number of Surveyed States (Incl. California)	California Rank	California Exceeds National Mean by:
California Community Colleges	9	3	8.7%
The California State University			
Lower Division	15	14	-34.4%
Upper Division	15	11	-16.0
Graduate	14	10	-13.3
University of California			
Lower Division	15	14	-31.3%
Upper Division	15	11	-18.3
Graduate	N/A	N/A	N/A

Source: MGT, 1989a

In the future, the problem of inaccuracy should be eliminated, since the University will convert to a workload reporting system based on actual and projected weekly student contact hours; this should produce far more accurate data on actual utilization as well as space needs. Until the new standards are approved and that system is in place, however, the effect of the proposed new standards should be regarded only as an approximation.

The assignable-square-feet-per-station standards proposed by the University of California are shown in Displays 66 through 71, on pages 91-96. They also contain five categories -- in this case ranging from 40 to 90 assignable square feet/station, including support space. Displays 70 and 71 employ the same utilization standard proposed by the State University -- 25 weekly room hours at 80 percent station occupancy for all levels. The effect of this change, based on the computer model, is a 4.5 percent increase in assignable square feet, although for reasons noted below, that increase should be considered as an approximation. In some cases, the new assignable-square-feet-per-station standards propose decreases, principally in engineering, while in others, notably the physical sciences, they have been increased. There is also one proposed change in the disciplinary taxonomy developed for the national survey: the transfer of the performing arts into the "non-capacity" space category. The University has requested this deletion for the following reason (Heinecke, 1989):

> We believe that teaching facilities for Performing Arts programs should be classified as "non-standard" space because neither the utilization standard nor the space/station standard is readily applicable to this type of space. Performing Arts teaching facilities encompass a wide range of room types, such as individual and group music practice rooms; music, radio, and television recording studios and associated support space; dance and drama rehearsal studios; theaters and concert halls regularly used for classes and rehearsals; and set design, costume design and other production facilities. These facilities are used intensively and interchangeably for scheduled classes and by individuals and groups for follow-up assignments and rehearsals. Station size and room capacity is not easily quantified. For example, the same size dance studio may be needed for a large introductory lower-division dance class of 25, a smaller, specialized upper-division class of 10, individual instruction on the graduate level, and non-scheduled but required practice and rehearsal.

The standards proposed here resulted from the University's own intensive study of its class laboratory

(text continued on page 97)

DISPLAY 58 California Community College Teaching Laboratory Data

Discipline	Proportion of Students	ASF/Station	Space Factor[1]	Multiplier[2]
Agriculture	0.9%	115.0	4.92	0.04
Air Conditioning	0.3%	130.0	5.56	0.01
Architecture	0.0%	60.0	2.57	0.00
Auto-Body & Fender	1.1%	200.0	8.56	0.09
Auto-Mechanic	1.1%	200.0	8.56	0.09
Auto-Technology	1.1%	75.0	3.21	0.03
Aviation Maintenance	0.5%	175.0	7.49	0.03
Biological Sciences	3.0%	55.0	2.35	0.07
Business & Management	8.8%	30.0	1.28	0.11
Carpentry	0.7%	175.0	7.49	0.05
Commercial Services	1.4%	50.0	2.14	0.03
Communications	0.7%	50.0	2.14	0.02
Computer & Information Sciences	3.5%	40.0	1.71	0.06
Diesel	0.3%	200.0	8.56	0.02
Dry-Wall	0.7%	175.0	7.49	0.05
Education	7.9%	75.0	3.21	0.25
Electricity	0.7%	175.0	7.49	0.05
Engineering	0.4%	75.0	3.21	0.01
Fine & Applied Arts	7.3%	60.0	2.57	0.19
Foreign Languages	2.3%	35.0	1.50	0.03
Glazing	0.7%	175.0	7.49	0.05
Graphic Arts	7.3%	80.0	3.42	0.25
Health Services	3.8%	50.0	2.14	0.08
Heavy Equipment	0.3%	200.0	8.56	0.02
Home Economics	2.4%	60.0	2.57	0.06
Interdisciplinary Studies	7.8%	60.0	2.57	0.20
Letters	6.8%	35.0	1.50	0.10
Library Science	0.0%	35.0	1.50	0.00
Machine Tools	1.1%	90.0	3.85	0.04
Masonry	0.7%	175.0	7.49	0.05
Mathematics	5.3%	35.0	1.50	0.08
Metal Trades	1.1%	90.0	3.85	0.04
Millwork	0.7%	90.0	3.85	0.03
Painting	0.7%	175.0	7.49	0.05
Physical Sciences	3.5%	60.0	2.57	0.09
Plastering	0.7%	175.0	7.49	0.05
Plastics	0.0%	130.0	5.56	0.00
Plumbing	0.7%	175.0	7.49	0.05
Psychology	2.4%	35.0	1.50	0.04
Public Affairs & Services	2.2%	50.0	2.14	0.05
Refrigeration	0.3%	130.0	5.56	0.01
Roofing	0.7%	175.0	7.49	0.05
Small Engine Repair	1.1%	100.0	4.28	0.05
Social Sciences	6.4%	35.0	1.50	0.10
Stationary Engineering	0.3%	200.0	8.56	0.02
Welding	1.1%	90.0	3.85	0.04
Total	100.0%			
Weighted Average[3]				2.86

1. Space factor based on a utilization rate of 27.5 weekly room hours and 85 percent station occupancy percentage to produce ASF/WSCH.
2. Space factor times proportion of students.
3. Weighted by the proportion of students in each discipline.

Source: MGT, 1989b

DISPLAY 59 Existing Community College Teaching Laboratory Data, Arrayed by Assignable Square Feet per Station, with Five New Categories

Existing Array

30 to 30.9 ASF/Station

Discipline	ASF/Station[1]
Business and Management	30.0
Foreign Languages	35.0
Letters	35.0
Library Science	35.0
Mathematics	35.0
Psychology[2]	*35.0*
Social Sciences	35.0

40 to 49.9 ASF/Station

Discipline	ASF/Station[1]
Computer and Info. Sciences	40.0

50 to 59.9 ASF/Station

Discipline	ASF/Station[1]
Commercial Services	50.0
Communications[2]	*50.0*
Health Services	50.0
Public Affairs & Services[2]	*50.0*
Biological Sciences	55.0

60 to 69.9 ASF/Station

Discipline	ASF/Station[1]
Architecture	60.0
Fine & Applied Arts	60.0
Home Economics	60.0
Interdisciplinary Studies[2]	*60.0*
Physical Sciences	60.0

70 to 79.9 ASF/Station

Discipline	ASF/Station[1]
Auto-Technology	75.0
Education[2]	*75.0*
Engineering	75.0

80 to 89.9 ASF/Station

Discipline	ASF/Station[1]
Graphic Arts	80.0

90 to 99.9 ASF/Station

Discipline	ASF/Station[1]
Machine Tools	90.0
Metal Trades	90.0
Millwork	90.0
Welding	90.0

100 to 109.9 ASF/Station

Discipline	ASF/Station[1]
Small Engine Repair	100.0

110 to 119.9 ASF/Station

Discipline	ASF/Station[1]
Agriculture[2]	*115.0*

120 to 159.9 ASF/Station

Discipline	ASF/Station[1]
Air Conditioning	130.0
Plastics	130.0
Refrigeration	130.0

160 or More ASF/Station

Discipline	ASF/Station[1]
Auto Body & Fender	200.0
Auto Mechanic	200.0
Aviation Maintenance	175.0
Carpentry	175.0
Diesel	200.0
Dry Wall	175.0
Electricity	175.0
Glazing	175.0
Heavy Equipment	200.0
Masonry	175.0
Painting	175.0
Plastering	175.0
Plumbing	175.0
Roofing	175.0
Stationary Engineering	200.0

Category I: 33 ASF/Station

Category II: 45 ASF/Station

Category III: 65 ASF/Station

Category IV: 120 ASF/Station

Category V: 185 ASF/Station

1. Includes support and service areas.
2. Italicized disciplines are moved to higher or lower ASF/station categories.

Source: Commission Staff

DISPLAY 60 Community College Teaching Laboratory Data, Arrayed by Assignable Square Feet per Station, with Five New Categories and Net Change from Existing Standards

New Array
Category I: 33 ASF/Station
Discipline (48.1% of Total)

Business & Management
Communications
Foreign Languages
Interdisciplinary Studies
Letters
Library Science
Mathematics
Public Affairs & Services
Social Sciences

Category II: 45 ASF/Station
Discipline (9.7% of Total)

Computer & Information Sciences
Education
Health Services
Psychology

Category III: 65 ASF/Station
Discipline (27.1% of Total)

Agriculture
Architecture
Auto-Technology
Biological Sciences
Commercial Services
Engineering
Fine & Applied Arts
Graphic Arts
Home Economics
Physical Sciences

Category IV: 120 ASF/Station
Discipline (5.7% of Total)

Air Conditioning
Machine Tools
Metal Trades
Millwork
Plastics
Refrigeration
Small Engine Repair
Welding

Category V: 185 ASF/Station
Discipline (9.3% of Total)

Auto-Body & Fender
Auto-Mechanic
Aviation Maintenance
Carpentry
Diesel
Dry-Wall
Electricity
Glazing
Heavy Equipment
Masonry
Painting
Plastering
Plumbing
Roofing
Stationary Engineering

Net Effect of New Array

Discipline	Proportion of Students	ASF/ Station	Space Factor[1]	Multiplier[2]
Agriculture	0.9%	65	3.01	0.03
Air Conditioning	0.3%	120	5.56	0.01
Architecture	0.0%	65	3.01	0.00
Auto-Body & Fender	1.1%	185	8.56	0.09
Auto-Mechanic	1.1%	185	8.56	0.09
Auto-Technology	1.1%	65	3.01	0.03
Aviation Maintenance	0.5%	185	8.56	0.04
Biological Sciences	3.0%	65	3.01	0.09
Business & Management	8.8%	33	1.53	0.13
Carpentry	0.7%	185	8.56	0.06
Commercial Services	1.4%	65	3.01	0.04
Communications	0.7%	33	1.53	0.01
Computer & Info. Sciences	3.5%	45	2.08	0.07
Diesel	0.3%	185	8.56	0.02
Dry-Wall	0.7%	185	8.56	0.06
Education	7.9%	45	1.53	0.12
Electricity	0.7%	185	8.56	0.06
Engineering	0.4%	65	3.01	0.01
Fine & Applied Arts	7.3%	65	3.01	0.22
Foreign Languages	2.3%	33	1.53	0.04
Glazing	0.7%	185	8.56	0.06
Graphic Arts	7.3%	65	3.01	0.22
Health Services	3.8%	45	2.08	0.08
Heavy Equipment	0.3%	185	8.56	0.02
Home Economics	2.4%	65	3.01	0.07
Interdisciplinary Studies	7.8%	33	1.53	0.12
Letters	6.8%	33	1.53	0.10
Library Science	0.0%	33	1.53	0.00
Machine Tools	1.1%	120	5.56	0.06
Masonry	0.7%	185	8.56	0.06
Mathematics	5.3%	33	1.53	0.08
Metal Trades	1.1%	120	5.56	0.06
Millwork	0.7%	120	5.56	0.04
Painting	0.7%	185	8.56	0.06
Physical Sciences	3.5%	65	3.01	0.10
Plastering	0.7%	185	8.56	0.06
Plastics	0.0%	120	5.56	0.00
Plumbing	0.7%	185	8.56	0.06
Psychology	2.4%	45	2.08	0.05
Public Affairs & Services	2.2%	33	1.53	0.03
Refrigeration	0.3%	120	5.56	0.01
Roofing	0.7%	185	8.56	0.06
Small Engine Repair	1.1%	120	5.56	0.06
Social Sciences	6.4%	33	1.53	0.10
Stationary Engineering	0.3%	185	8.56	0.02
Welding	1.1%	120	5.56	0.06
Total	**100.0%**			
Weighted Average[3]				**2.914**
Net Change from Existing Weighted Average of 2.857				**2.0%**

1. Space factor based on a utilization rate of 27 weekly room hours and 80 percent station occupancy percentage (existing standard is 27.5 and 85 percent), with support space included to produce ASF/WSCH.
2. Space factor times proportion of students.
3. Weighted by the proportion of students in each discipline.

Source: Commission Staff

DISPLAY 61 California State University Teaching Laboratory Data

Discipline	Proportion of Students	ASF per Station LD	ASF per Station UD	Percent Add-on for Support Space	Total ASF per Station LD	Total ASF per Station UD	Space Factor LD[1]	Space Factor UD[2]	Multiplier[3] LD	Multiplier[3] UD
Agriculture	1.2%	60.0	60.0	10.0%	66.0	66.0	2.824	3.750	0.034	0.045
Anthropology	1.2%	42.5	45.0	7.5%	45.7	48.4	1.955	2.749	0.023	0.033
Architecture	0.6%	68.0	82.7	15.0%	78.2	95.1	3.345	5.404	0.020	0.032
Area Studies	0.6%	30.0	30.0	5.0%	31.5	31.5	1.348	1.790	0.008	0.011
Art	2.4%	65.0	65.0	10.0%	71.5	71.5	3.059	4.063	0.073	0.098
Biological Science	3.9%	55.0	60.0	10.0%	60.5	66.0	2.588	3.750	0.101	0.146
Broadcast Communication Arts	0.5%	30.0	60.0	10.0%	33.0	66.0	1.412	3.750	0.007	0.019
Business Admin. & Economics	17.5%	30.0	30.0	7.0%	32.1	32.1	1.373	1.824	0.240	0.319
Communications	1.7%	30.0	30.0	5.0%	31.5	31.5	1.348	1.790	0.023	0.030
Computer Science	2.6%	49.0	49.0	5.0%	51.5	51.5	2.201	2.923	0.057	0.076
Education	6.4%	60.0	60.0	10.0%	66.0	66.0	2.824	2.500	0.181	0.240
Engineering, CAD/CAM	0.1%	86.0	86.0	15.0%	98.9	98.9	4.231	5.619	0.004	0.005
Engineering, other	5.3%	90.0	110.0	15.0%	103.5	126.5	4.428	7.187	0.235	0.388
Fine Arts	4.3%	60.0	80.0	10.0%	66.0	88.0	2.824	5.000	0.121	0.215
Foreign Languages	2.6%	40.0	40.0	5.0%	42.0	42.0	1.797	2.386	0.047	0.062
Geograpy	1.4%	42.5	45.0	7.5%	45.7	48.4	1.955	2.749	0.027	0.038
Health Professions	3.7%	40.0	50.0	10.0%	44.0	55.0	1.882	3.125	0.070	0.116
Health Science	0.1%	40.0	50.5	10.0%	44.0	55.6	1.882	3.156	0.002	0.003
Home Economics	1.5%	60.0	60.0	10.0%	66.0	66.0	2.824	3.750	0.042	0.056
Humanities, General	10.7%	40.0	40.0	5.0%	42.0	42.0	1.797	2.386	0.192	0.255
Industrial Arts	1.0%	68.0	82.7	15.0%	78.2	95.1	3.345	5.404	0.033	0.054
Journalism	0.6%	60.0	60.0	10.0%	66.0	66.0	2.824	3.750	0.017	0.023
Mathematics	5.5%	30.0	30.0	5.0%	31.5	31.5	1.348	1.790	0.074	0.098
Physical Science	5.4%	60.0	70.0	10.0%	66.0	77.0	2.824	4.375	0.152	0.236
Psychology	4.1%	40.0	60.0	7.5%	43.0	64.5	1.840	3.665	0.075	0.150
Public Administration	2.4%	30.0	30.0	5.0%	31.5	31.5	1.348	1.790	0.032	0.043
Social Sciences, General	12.7%	30.0	30.0	5.0%	31.5	31.5	1.348	1.790	0.171	0.227
Total	**100.0%**									
Unweighted Average							2.325	2.745		
Weighted Average[4]									2.064	3.015

1. Space factor based on various assignable square feet per station standards divided by a utilization rate of 27.5 weekly room hours and 85 percent station occupancy percentage.
2. Space factor based on various assignable square feet per station standards divided by a utilization rate of 24.0 weekly room hours and 80 percent station occupancy percentage.
3. Space factor times proportion of students.
4. Weighted by the proportion of students in each discipline.

Source: MGT, 1989b

DISPLAY 62 Existing California State University Lower-Division Teaching Laboratory Assignable-Square-Feet-per-Station Standards, with Five New Categories

Existing Array **30 to 39.9 ASF/Station** Discipline	ASF/ Station[1]
Area Studies	31.5
Broadcast Communication Arts[2]	*33.0*
Business Admin. & Economics	32.1
Communications	31.5
Mathematics	31.5
Public Administration	31.5
Social Sciences, General	31.5
40 to 49.9 ASF/Station	ASF/
Discipline	Station
Anthropology	45.7
Foreign Languages	42.0
Geography	45.7
Health Professions	44.0
Health Science	44.0
Humanities, General	42.0
Psychology	43.0
50 to 59.9 ASF/Station	ASF/
Discipline	Station
Computer Science	51.5
60 to 69.9 ASF/Station	ASF/
Discipline	Station
Agriculture	66.0
Biological Science	60.5
Education[2]	*66.0*
Fine Arts[2]	*66.0*
Home Economics	66.0
Journalism	66.0
Physical Science[1]	*66.0*
70 to 79.9 ASF/Station	ASF/
Discipline	Station
Architecture	78.2
Art	71.5
Industrial Arts	78.2
80 or More ASF/Station	ASF/
Discipline	Station
Engineering, CAD/CAM	98.9
Engineering, Other	103.5

35 ASF/Station

Category II: 50 ASF/Station

Category III: 65 ASF/Station

Category IV: 85 ASF/Station

Category V: 110 ASF/Station

New Array
Category I: 35 ASF/Station
Discipline (40.4% of Total)

Area Studies
Business Administration & Economics
Communications
Mathematics
Public Administration
Social Sciences, General

Category II: 50 ASF/Station
Discipline (33.3% of Total)

Anthropology
Broadcast Communication Arts
Computer Science
Education
Foreign Languages
Geography
Health Professions
Health Science
Humanities, General
Psychology

Category III: 65 ASF/Station
Discipline (7.2% of Total)

Agriculture
Biological Science
Home Economics
Journalism

Category IV: 85 ASF/Station
Discipline (13.7% of Total)

Architecture
Art
Fine Arts
Industrial Arts
Physical Science

Category V: 110 ASF/Station
Discipline (5.4% of Total)

Engineering, CAD/CAM
Engineering, Other

1. Including Support Space.
2. Italicized disciplines are moved to higher or lower ASF/Station categories.

Source: Commission Staff

DISPLAY 63 *Existing California State University Upper-Division Teaching Laboratory Assignable-Square-Feet-per-Station Standards, with Five New Categories*

Existing Array **30 to 39.9 ASF/Station** Discipline	ASF/ Station[1]
Area Studies	31.5
Business Admin. & Economics	32.1
Communications	31.5
Mathematics	31.5
Public Administration	31.5
Social Sciences, General	31.5
40 to 49.9 ASF/Station Discipline	ASF/ Station
Anthropology	48.4
Foreign Languages	42.0
Geography	48.4
Humanities, General	42.0
50 to 59.9 ASF/Station Discipline	ASF/ Station
Computer Science	51.5
Health Professions	55.0
Health Science	55.0
60 to 69.9 ASF/Station Discipline	ASF/ Station
Agriculture	66.0
Biological Science	66.0
Broadcast Communication Arts[2]	*66.0*
Education[2]	*66.0*
Home Economics	66.0
Journalism	66.0
Psychology[2]	*64.5*
70 to 79.9 ASF/Station Discipline	ASF/ Station
Art	71.5
Physical Science	77.0
80 to 99.9 ASF/Station Discipline	ASF/ Station
Architecture	95.1
Fine Arts	88.0
Industrial Arts	95.1
100 or More ASF/Station Discipline	ASF/ Station
Engineering, CAD/CAM	98.9
Engineering, Other	126.5

Category I: 35 ASF/Station

Category II: 50 ASF/Station

Category III: 65 ASF/Station

Category IV: 85 ASF/Station

Category V: 110 ASF/Station

New Array

Category I: 35 ASF/Station
Discipline (40.4% of Total)

Area Studies
Business Administration & Economics
Communications
Mathematics
Public Administration
Social Sciences, General

Category II: 50 ASF/Station
Discipline (33.3% of Total)

Anthropology
Broadcast Communication Arts
Computer Science
Education
Foreign Languages
Geography
Health Professions
Health Science
Humanities, General
Psychology

Category III: 65 ASF/Station
Discipline (7.2% of Total)

Agriculture
Biological Science
Home Economics
Journalism

Category IV: 85 ASF/Station
Discipline (13.7% of Total)

Architecture
Art
Fine Arts
Industrial Arts
Physical Science

Category V: 110 ASF/Station
Discipline (5.4% of Total)

Engineering, CAD/CAM
Engineering, Other

1. Including Support Space.
2. Italicized disciplines are moved to higher or lower ASF/Station categories.

Source: Commission Staff

DISPLAY 64 *New California State University Teaching Laboratory Space and Utilization Standards (including Support Space) with the Net Effect on Existing Lower-Division Standards*

Discipline	Proportion of Students	ASF/ Station	Space Factor[1]	Multiplier[2]
Agriculture	1.2%	65	3.250	0.039
Anthropology	1.2%	50	2.500	0.030
Architecture	0.6%	85	4.250	0.026
Area Studies	0.6%	35	1.750	0.011
Art	2.4%	85	4.250	0.102
Biological Science	3.9%	65	3.250	0.127
Broadcast Comm. Arts	0.5%	50	2.500	0.013
Business Admin. & Econ.	17.5%	35	1.750	0.306
Communications	1.7%	35	1.750	0.030
Computer Science	2.6%	50	2.500	0.065
Education	6.4%	50	2.500	0.160
Engineering, CAD/CAM	0.1%	110	5.500	0.006
Engineering, other	5.3%	110	5.500	0.292
Fine Arts	4.3%	85	4.250	0.183
Foreign Languages	2.6%	50	2.500	0.065
Geography	1.4%	50	2.500	0.035
Health Professions	3.7%	50	2.500	0.093
Health Science	0.1%	50	2.500	0.003
Home Economics	1.5%	65	3.250	0.049
Humanities, General	10.7%	50	2.500	0.268
Industrial Arts	1.0%	85	4.250	0.043
Journalism	0.6%	65	3.250	0.020
Mathematics	5.5%	35	1.750	0.096
Physical Science	5.4%	85	4.250	0.230
Psychology	4.1%	50	2.500	0.103
Public Administration	2.4%	35	1.750	0.042
Social Sciences, General	12.7%	35	1.750	0.222
Total	**100.0%**			
Weighted Average				**2.653**[3]
Net Change from Existing Lower Division Weighted Average of 2.064				**+28.5%**

1. The "Space Factor" shown in the fourth column above is expressed in terms of assignable square feet per weekly student contact hour. It is defined as the "ASF/station" number shown in the third column divided by the new utilization standard of 25 weekly room hours times an 80 percent station occupancy percentage. The existing standard is 27.5 weekly room hours with an 85 percent station occupancy percentage. Service and storage areas are included.
2. "Space factor" times "Proportion of Students."
3. The weighted average is defined as the "Space Factor" shown in the fourth column above weighted by the proportion of students in each discipline.

Source: Displays 61 through 63.

DISPLAY 65 *New California State University Teaching Laboratory Space and Utilization Standards (including Support Space) with the Net Effect on Existing Upper-Division Standards and Overall Effect on Combined Lower- and Upper-Division Standards*

Discipline	Proportion of Students	ASF/ Station	Space Factor[1]	Multiplier[2]
Agriculture	1.2%	65	3.250	0.039
Anthropology	1.2%	50	2.500	0.030
Architecture	0.6%	85	4.250	0.026
Area Studies	0.6%	35	1.750	0.011
Art	2.4%	85	4.250	0.102
Biological Science	3.9%	65	3.250	0.127
Broadcast Comm. Arts	0.5%	50	2.500	0.013
Business Admin. & Econ.	17.5%	35	1.750	0.306
Communications	1.7%	35	1.750	0.030
Computer Science	2.6%	50	2.500	0.065
Education	6.4%	50	2.500	0.160
Engineerng, CAD/CAM	0.1%	110	5.500	0.006
Engineering, other	5.3%	110	5.500	0.292
Fine Arts	4.3%	85	4.250	0.183
Foreign Languages	2.6%	50	2.500	0.065
Geography	1.4%	50	2.500	0.035
Health Professions	3.7%	50	2.500	0.093
Health Science	0.1%	50	2.500	0.003
Home Economics	1.5%	65	3.250	0.049
Humanities, General	10.7%	50	2.500	0.268
Industrial Arts	1.0%	85	4.250	0.043
Journalism	0.6%	65	3.250	0.020
Mathematics	5.5%	35	1.750	0.096
Physical Science	5.4%	85	4.250	0.230
Psychology	4.1%	50	2.500	0.103
Public Administration	2.4%	35	1.750	0.042
Social Sciences, General	12.7%	35	1.750	0.222
Total	**100.0%**			
Weighted Average				**2.653**[3]
Net Change from Existing Upper Division Weighted Average of 3.015				**-12.0%**
Net Change from Existing Lower and Upper Division Standards				**+1.9%**[4]

1. The "Space Factor" shown in the fourth column above is expressed in terms of assignable square feet per weekly student contact hour. It is defined as the "ASF/station" number shown in the third column divided by the new utilization standard of 25 weekly room hours times an 80 percent station occupancy percentage. The existing standard is 27.5 weekly room hours with an 85 percent station occupancy percentage. Service and storage areas are included.
2. "Space factor" times "Proportion of Students."
3. The weighted average is defined as the "Space Factor" shown in the fourth column above weighted by the proportion of students in each discipline.
4. Net Effect created by multiplying the 28.5 percent increase in lower division standards by 34.3 percent, and the 12.0 percent decrease in upper/graduate division standards by 65.7 percent to reflect the mix between lower and upper/graduate division enrollments.

Source: Displays 61 through 63.

DISPLAY 66 University of California Lower-Division Teaching Laboratory Data

Discipline	Proportion of Students	WSCH/FTE	ASF/Station	Percent Add-on for Support Space	Total ASF per Station	Space Factor[1]	Multiplier[2]
Administration	0.9%	6.3	33	6.7%	35.211	9.49	0.089
Agricultural Biological Sciences	0.3%	13.6	58	10.0%	63.800	37.12	0.116
Agricultural Economics	0.1%	6.3	33	6.7%	35.211	9.49	0.010
Agricultural Science	0.6%	13.2	60	10.0%	66.000	37.27	0.234
Anthropology	2.6%	8.1	43	7.5%	46.225	16.02	0.419
Architecture (Environ. Design)	0.3%	17.3	65	10.0%	71.500	52.92	0.166
Arts, Visual	3.1%	17.3	65	10.0%	71.500	52.92	1.661
Biological Sciences	6.5%	14.0	55	10.0%	60.500	36.24	2.350
Computer Science	0.7%	9.1	45	10.0%	49.500	19.27	0.141
Education	0.2%	14.7	40	10.0%	44.000	27.67	0.058
Engineering Sciences	3.0%	18.1	90	15.0%	103.500	80.14	2.431
Engineering, Agriculture	0.0%	18.1	90	15.0%	103.500	80.14	0.000
Engineering, Chemical	0.0%	14.3	75	12.5%	84.375	51.62	0.000
Foreign Languages	8.2%	3.0	40	5.0%	42.000	5.39	0.440
Geography	1.2%	6.3	45	7.5%	48.375	13.04	0.150
International Relations	0.0%	14.7	40	10.0%	44.000	27.67	0.000
Journalism	0.0%	14.7	40	10.0%	44.000	27.67	0.000
Law	0.0%	14.7	40	10.0%	44.000	27.67	0.000
Letters	20.8%	3.0	40	5.0%	42.000	5.39	1.122
Library Sciences	0.1%	14.7	40	10.0%	44.000	27.67	0.029
Mathematical Sciences	13.6%	3.0	30	5.0%	31.500	4.04	0.550
Physical Science	15.5%	10.4	60	10.0%	66.000	29.36	4.546
Psychology	4.2%	8.1	43	7.5%	46.225	16.02	0.670
Social Ecology	0.4%	8.1	45	7.5%	48.375	16.76	0.070
Social Sciences, General	16.3%	2.1	30	5.0%	31.500	2.83	0.462
Social Welfare	0.0%	2.1	30	5.0%	31.500	2.83	0.000
Speech	0.0%	7.0	48	7.5%	51.600	15.45	0.000
Studies, Applied Behavioral	0.3%	14.7	40	10.0%	44.000	27.67	0.087
Studies, Creative	0.0%	3.0	40	5.0%	42.000	5.39	0.000
Studies, Environmental	0.1%	14.0	55	10.0%	60.500	36.24	0.038
Studies, Interdisciplinary	0.8%	2.1	30	5.0%	31.500	2.83	0.024
Total	**100.00%**						
Weighted Average							15.862[3]

1. The "Space Factor" is expressed in terms of assignable square feet per weekly student contact hour. It is defined as the "ASF/ station" number shown in the fourth column divided by the utilization standard of 27.5 weekly room hours times an 85 percent station occupancy percentage. Service and storage areas are included.
2. Space factor times proportion of students.
3. Weighted by the proportion of students in each discipline.

Source: MGT, 1989b

DISPLAY 67 University of California Upper-Division Teaching Laboratory Data

Discipline	Proportion of Students	WSCH/FTE	ASF/Station	Percent Add-on for Support Space	Total ASF per Station	Space Factor[1]	Multiplier[2]
Administration	2.1%	5.3	33	6.7%	35.211	9.49	0.224
Agricultural Biological Sciences	1.3%	12.0	60	10.0%	66.000	37.12	0.570
Agricultural Economics	0.8%	5.3	33	6.7%	35.211	9.49	0.089
Agricultural Science	2.2%	11.9	60	10.0%	66.000	37.27	0.989
Anthropology	2.1%	6.5	45	7.5%	48.375	16.02	0.377
Architecture (Environ. Design)	1.3%	16.8	65	10.0%	71.500	52.92	0.864
Arts, Visual	3.1%	16.8	65	10.0%	71.500	52.92	2.088
Biological Sciences	7.7%	12.1	60	10.0%	66.000	36.24	3.494
Computer Science	0.7%	3.0	55	10.0%	60.500	19.27	0.076
Education	1.7%	14.4	40	10.0%	44.000	27.67	0.608
Engineering Sciences	10.1%	6.0	110	15.0%	126.500	80.14	4.367
Engineering, Agriculture	0.1%	6.0	110	15.0%	126.500	80.14	0.045
Engineering, Chemical	0.2%	8.0	90	12.5%	101.250	51.62	0.097
Foreign Languages	3.1%	3.0	40	5.0%	42.000	5.39	0.292
Geography	1.1%	5.4	50	7.5%	53.750	13.04	0.174
International Relations	0.0%	14.4	40	10.0%	44.000	27.67	0.000
Journalism	0.1%	14.4	40	10.0%	44.000	27.67	0.038
Law	0.3%	14.4	40	10.0%	44.000	27.67	0.114
Letters	12.7%	3.0	40	5.0%	42.000	5.39	1.208
Library Sciences	0.1%	14.4	40	10.0%	44.000	27.67	0.038
Mathematical Sciences	4.3%	3.0	30	5.0%	31.500	4.04	0.310
Physical Science	4.7%	9.9	70	10.0%	77.000	29.36	2.056
Psychology	8.5%	6.5	45	7.5%	48.375	16.02	1.527
Social Ecology	0.9%	6.5	45	7.5%	48.375	16.76	0.170
Social Sciences, General	27.8%	0.8	30	5.0%	31.500	2.83	0.399
Social Welfare	0.1%	0.8	30	5.0%	31.500	2.83	0.002
Speech	0.0%	6.1	50	7.5%	53.750	15.45	0.000
Studies, Applied Behavioral	0.4%	14.4	40	10.0%	44.000	27.67	0.152
Studies, Creative	0.0%	3.0	40	5.0%	42.000	5.39	0.000
Studies, Environmental	0.4%	12.1	60	10.0%	66.000	36.24	0.191
Studies, Interdisciplinary	1.9%	0.8	30	5.0%	31.500	2.83	0.027
Total	**100.00%**						
Weighted Average							**20.132**[3]

1. The "Space Factor" is expressed in terms of assignable square feet per weekly student contact hour. It is defined as the "ASF/ station" number shown in the fourth column divided by the utilization standard of 22.0 weekly room hours times an 80 percent station occupancy percentage. Service and storage areas are included.
2. Space factor times proportion of students.
3. Weighted by the proportion of students in each discipline.

Source: MGT, 1989b

DISPLAY 68 *Existing University of California Lower-Division Teaching Laboratory Assignable-Square-Feet-per-Station Standards, with Five New Categories*

Existing Array **30 to 39.9 ASF/Station** Discipline	ASF/ Station[1]
Administration	35.21
Agricultural Economics	35.21
Mathematical Sciences	31.50
Social Sciences, General	31.50
Social Welfare	31.50
Studies, Interdisciplinary	31.50
40 to 49.9 ASF/Station Discipline	ASF/ Station
Anthropology[2]	*46.23*
Computer Science[2]	*49.50*
Education	44.00
Foreign Languages	42.00
Geography	*48.38*
International Relations	44.00
Journalism	44.00
Law	44.00
Letters	42.00
Library Sciences	44.00
Psychology[2]	*46.23*
Social Ecology[2]	*48.38*
Studies, Applied Behavioral	44.00
Studies, Creative	42.00
50 to 59.9 ASF/Station Discipline	ASF/ Station
Speech	51.60
60 to 69.9 ASF/Station Discipline	ASF/ Station
Agricultural Biological Sciences	63.80
Agricultural Science	66.00
Biological Science	60.50
Physical Science[2]	*66.00*
Studies, Environmental[2]	*60.50*
70 to 79.9 ASF/Station Discipline	ASF/ Station
Architecture (Environ. Design)	71.50
Arts, Performing[3]	71.50
Arts, Visual	71.50
80 or More ASF/Station Discipline	ASF/ Station
Engineering, Agriculture	103.50
Engineering, Chemical	84.38
Engineering, Sciences	103.50

Categories I & II:
40 ASF/Station
&
50 ASF/Station

Categories III & IV
60 ASF/Station
&
75 ASF/Station

Category V:
90 ASF/Station

New Array

Category I: 40 ASF/Station
Discipline (61.5% of Total)

Administration
Agricultural Economics
Education
Foreign Languages
International Relations
Journalism
Law
Letters
Library Science
Mathematical Sciences
Social Sciences, General
Social Welfare
Studies, Applied Behavioral
Studies, Creative
Studies, Environmental
Studies, Interdisciplinary

Category II: 50 ASF/Station
Discipline (4.9% of Total)

Computer Science
Psychology

Category III: 60 ASF/Station
Discipline (4.4% of Total)

Agricultural Science
Anthropology
Geography

Category IV: 75 ASF/Station
Discipline (7.5% of Total)

Agricultural Biological Sciences
Architecture (Environmental Design)
Biological Sciences
Social Ecology
Speech

Category V: 90 ASF/Station
Discipline (21.7% of Total)

Arts, Visual
Engineering Sciences
Engineering, Agriculture
Engineering, Chemical
Physical Science

1. Including Support Space.
2. Italicized disciplines are moved to higher or lower ASF/Station categories.

Source: Commission Staff

DISPLAY 69 *Existing University of California Upper-Division Teaching Laboratory Assignable-Square-Feet-per-Station Standards, with Five New Categories*

Existing Array **30 to 39.9 ASF/Station** Discipline	ASF/ Station[1]
Administration	35.21
Agricultural Economics	35.21
Mathematical Sciences	31.50
Social Sciences, General	31.50
Social Welfare	31.50
Studies, Interdisciplinary	31.50
40 to 49.9 ASF/Station Discipline	ASF/ Station
Anthropology[2]	*48.38*
Education	44.00
Foreign Languages	42.00
International Relations	44.00
Journalism	44.00
Law	44.00
Letters	42.00
Library Sciences	44.00
Psychology[2]	*48.38*
Social Ecology[2]	*48.38*
Studies, Applied Behavioral	44.00
Studies, Creative	42.00
50 to 59.9 ASF/Station Discipline	ASF/ Station
Computer Science	60.50
Geography[2]	*53.75*
Speech[2]	*53.75*
60 to 69.9 ASF/Station Discipline	ASF/ Station
Agricultural Biological Sciences	66.00
Agricultural Science	66.00
Architecture, Environmental Design	71.50
Arts, Performing[3]	*71.50*
Arts, Visual[2]	*71.50*
Biological Science	60.50
Studies, Environmental[2]	*60.50*
70 to 79.9 ASF/Station Discipline	ASF/ Station
Physical Sciences[2]	*77.0*
80 or More ASF/Station Discipline	ASF/ Station
Engineering, Agriculture	126.50
Engineering, Chemical	101.25
Engineering, Sciences	126.50

Category I: 40 ASF/Station

Category II: 50 ASF/Station

Categories III & IV: 60 ASF/Station & 75 ASF/Station

Category V: 90 ASF/Station

New Array

Category I: 40 ASF/Station
Discipline (55.9% of Total)

Administration
Agricultural Economics
Education
Foreign Languages
International Relations
Journalism
Law
Letters
Library Science
Mathematical Sciences
Social Sciences, General
Social Welfare
Studies, Applied Behavioral
Studies, Creative
Studies, Environmental
Studies, Interdisciplinary

Category II: 50 ASF/Station
Discipline (4.9% of Total)

Computer Science
Psychology

Category III: 60 ASF/Station
Discipline (4.4% of Total)

Agricultural Science
Anthropology
Geography

Category IV: 75 ASF/Station
Discipline (7.5% of Total)

Agricultural Biological Sciences
Architecture (Environmental Design)
Biological Sciences
Social Ecology
Speech

Category V: 90 ASF/Station
Discipline (21.7% of Total)

Arts, Visual
Engineering Sciences
Engineering, Agriculture
Engineering, Chemical
Physical Science

1. Including Support Space.
2. Italicized disciplines are moved to higher or lower ASF/Station categories.

Source: Commission Staff

DISPLAY 70 New University of California Teaching Laboratory Space and Utilization Standards (Including Support Space) With the Net Effect on Existing Lower-Division Standards

Discipline	Proportion of Students	WSCH per FTE	ASF per Station	Space Factor[1]	Multiplier[2]
Administration	0.9%	6.3	40	12.115	0.114
Agricultural Biol. Sciences	0.3%	13.6	75	49.038	0.154
Agricultural Economics	0.1%	6.3	40	12.115	0.013
Agricultural Science	0.6%	13.2	60	38.077	0.239
Anthropology	2.6%	8.1	60	23.365	0.611
Arch. (Environ. Design)	0.3%	17.3	75	62.380	0.196
Arts, Visual	3.1%	17.3	90	74.856	2.349
Biological Sciences	6.5%	14.0	75	50.481	3.274
Computer Science	0.7%	9.1	50	21.875	0.160
Education	0.2%	14.7	40	28.269	0.059
Engineering Sciences	3.0%	18.1	90	78.317	2.376
Engineering, Agriculture	0.0%	18.1	90	78.317	0.000
Engineering, Chemical	0.0%	14.3	90	61.875	0.000
Foreign Languages	8.2%	3.0	40	5.769	0.471
Geography	1.2%	6.3	60	18.173	0.209
International Relations	0.0%	14.7	40	28.269	0.000
Journalism	0.0%	14.7	40	28.269	0.000
Law	0.0%	14.7	40	28.269	0.000
Letters	2.1%	3.0	40	5.769	1.201
Library Sciences	0.1%	14.7	40	28.269	0.030
Mathematical Sciences	13.6%	3.0	40	5.769	0.785
Physical Science	15.5%	10.4	90	45.000	6.967
Psychology	4.2%	8.1	50	19.471	0.815
Social Ecology	0.4%	8.1	75	29.207	0.122
Social Sciences, General	16.3%	2.1	40	4.038	0.659
Social Welfare	0.0%	2.1	40	4.038	0.000
Speech	0.0%	7.0	75	25.240	0.000
Studies, Applied Behavioral	0.3%	14.7	40	28.269	0.089
Studies, Creative	0.0%	3.0	40	5.769	0.000
Studies, Environmental	0.1%	14.0	40	26.923	0.028
Studies, Interdisciplinary	0.8%	2.1	40	4.038	0.034
Total	**100.0%**				
Weighted Average[3]					**15.862**
Net Change from Existing Weighted Average of 15.862					**32.1%**

1. The "Space Factor" shown in the fifth column above is expressed in terms of assignable square feet per full-time-equivalent student. It is defined as the "ASF/station" number shown in the fourth column divided by the new utilization standard (25 weekly room hours times an 80 percent station occupancy percentage), then multiplied by the "WSCH per FTE" number. The existing standard is 27.5 weekly room hours with an 85 percent station occupancy percentage. Service and storage areas are included.
2. "Space factor" times "Proportion of Students."
3. The weighted average is defined as the "Space Factor" shown in the fourth column above weighted by the proportion of students in each discipline.

Source: Displays 66 through 69.

DISPLAY 71 *Existing University of California Upper-Division Teaching Laboratory Assignable-Square-Feet-per-Station Standards (including Support Space), with Five Proposed New Categories and Net Effect on Existing Standards*

Discipline	Proportion of Students	WSCH per FTE	ASF per Station	Space Factor[1]	Multiplier[2]
Administration	2.1%	5.30	40.00	10.600	0.224
Agricultural Biol. Sciences	1.3%	12.00	75.00	45.000	0.570
Agricultural Economics	0.8%	5.30	40.00	10.600	0.089
Agricultural Science	2.2%	11.90	60.00	35.700	0.791
Anthropology	2.1%	6.50	60.00	19.500	0.411
Arch. (Environ. Design)	1.3%	16.80	75.00	63.000	0.797
Arts, Visual	3.1%	16.80	90.00	75.600	2.313
Biological Sciences	7.7%	12.10	75.00	45.375	3.494
Computer Science	0.7%	3.00	50.00	7.500	0.055
Education	1.7%	14.40	40.00	28.800	0.486
Engineering Sciences	10.1%	6.00	90.00	27.000	2.734
Engineering, Agriculture	0.1%	6.00	90.00	27.000	0.028
Engineering, Chemical	0.2%	8.00	90.00	36.000	0.076
Foreign Languages	3.1%	3.00	40.00	6.000	0.184
Geography	1.1%	5.40	60.00	16.200	0.171
International Relations	0.0	14.40	40.00	28.800	0.000
Journalism	0.1%	14.40	40.00	28.800	0.030
Law	0.3%	14.40	40.00	28.800	0.091
Letters	12.7%	3.00	40.00	6.000	0.759
Library Sciences	0.1%	14.40	40.00	28.800	0.030
Mathematical Sciences	4.3%	3.00	40.00	6.000	0.259
Physical Science	4.7%	9.90	90.00	44.550	2.115
Psychology	8.5%	6.50	50.00	16.250	1.388
Social Ecology	0.9%	6.50	75.00	24.375	0.231
Social Sciences, General	27.8%	0.80	40.00	1.600	0.446
Social Welfare	0.1%	0.80	40.00	1.600	0.002
Speech	0.0%	6.10	75.00	22.875	0.000
Studies, Applied Behavioral	0.4%	14.40	40.00	28.800	0.122
Studies, Creative	0.0%	3.00	40.00	6.000	0.000
Studies, Environmental	0.4%	12.10	40.00	24.200	0.102
Studies, Interdisciplinary	1.9%	0.80	40.00	1.600	0.030
Total	**100.0%**				
Weighted Average[3]					18.431
Net Change from Existing Weighted Average of 20.132					**-8.4%**
Net Change from Existing Lower and Upper Division Standards					**+4.5%**

1. The "Space Factor" shown in the fifth column above is expressed in terms of assignable square feet per full-time-equivalent student. It is defined as the "ASF/station" number shown in the fourth column divided by the new utilization standard (25 weekly room hours times an 80 percent station occupancy percentage), then multiplied by the "WSCH per FTE" number. The existing standard is 22.0 weekly room hours with an 80 percent station occupancy percentage. Service and storage areas are included.
2. "Space factor" times "Proportion of Students."
3. The weighted average is defined as the "Space Factor" shown in the fourth column above weighted by the proportion of students in each discipline.
4. Net Effect created by multiplying the 32.1 percent increase in lower division standards by 31.8 percent, and the 8.4 percent decrease in upper/graduate division standards by 68.2 percent to reflect the mix between lower and upper/graduate division enrollments.

Source: Displays 66 through 69.

needs, and are based primarily on actual State approvals and construction of facilities over the past five years. Even though the "net effect" shown in Display 71 produces an increase of 4.5 percent over existing standards, the standards are very similar to those proposed for the State University -- the principal difference being that they span a narrower range. As with the State University and the community colleges, the space-per-station numbers shown in Displays 70 and 71 are offered as status quo proposals, in part because shifts in the discipline mix over time will alter their overall effect considerably, and in part because the credit-hour/contact hour conversion problem makes a precise comparison difficult. As an example of how the discipline mix can affect the standards, if the University were to experience an enrollment decrease of 2 percent in engineering and a comparable 2 percent increase in a discipline such as administration (business) or mathematics, the "net effect" of the new standards would show a decrease over the existing standards. From this, it should be concluded that while the proposed standards will meet the segments' current needs, they nevertheless represent approximations and will probably need to be adjusted from time to time in the future.

6 Research Space

THE UNIVERSITY of California has long been considered among the nation's most pre-eminent research institutions. As a system, it occupies first place in the nation by a wide margin in terms of external research funding received, as indicated in Display 72 on page 100. On an individual campus basis, it operates seven of the top 100 institutions in the United States, and four of the top 20 -- not counting the additional funding accruing to the research laboratories at Livermore and Los Alamos (Display 73, page 101).

The University's research accomplishments have a long and distinguished history, particularly in agriculture and the sciences, and it may be because of that fact that California was among the first states to establish standards for research laboratory space. These standards were first considered in the 1955 *Restudy*, where the McConnell committee decided that research laboratory space standards should be established in nine discipline categories, just as they were for class laboratories, and based on assignable square feet per full-time-equivalent faculty member, with additional allowances for graduate students and support or service areas. These recommendations are shown in Display 74 on page 102.

The only other major study of space and utilization standards between 1955 and the present was undertaken by the Coordinating Council for Higher Education in 1966. The Council did not consider research space, however, since it was relatively well satisfied with the *Restudy* team's efforts. In addition, although the Legislature actively considered new standards for classrooms and teaching laboratories in 1970 and 1973, it did not consider changes in research space allocations. Negotiations did occur, however, between the University and the State Department of Finance that resulted in alterations in some of the standards and the creation of new standards in discipline areas not previously considered in the *Restudy*. These negotiations, although they followed the basic format of the *Restudy*, produced an array of standards that looked very different from the original 1955 formulation, as shown in Display 75 on page 103. It did not, however, produce research space that exceeded the 1955 limitations in any significant way.

Official interest in space standards, including those for research space, waned in the 1970s, primarily because of lowered growth rates and the absence of funding sources for capital outlay appropriations. Since the late 1950s, California had used general obligation bonds to fund most physical plant expansion and renovation, but with the defeat of Proposition 3 in 1968, no further bond issues for general campus construction were approved until 1986 -- although a $155.9 million bond issue was approved for University of California health science facilities in 1972.

State appropriations for the three public segments since 1970-71 are shown in Displays 76 and 77 on pages 104 and 105, and they show generally low appropriation levels until 1984-85, with the exception of a slight rise in 1973-74 and 1974-75 caused by increasing oil revenues from the 1973 OPEC crisis and also by the health sciences bond issue in 1972. The slump in the late 1970s and early 1980s occurred after bond funds were expended, tidelands oil revenues declined, and the economy entered a major recession. The $24.7 million in State funds appropriated in 1983-84 was the lowest for the entire twenty-year period shown.

Interest in space standards, and particularly in research laboratories, revived in 1984 with increased appropriations. As a result, the Legislature approved Supplemental Budget Language to the 1985 Budget Act that led to the development of *Time and Territory* and the Commission's preliminary conclusions on the research laboratory question:

> *Item 6420-001-001, Number 4. Capital Outlay Guidelines.* The California Postsecondary Education Commission (CPEC) shall study the current space and utilization standards for undergraduate class and graduate laboratories and faculty research/office space in public higher education. By December 1, 1985, the CPEC shall report its recommendations for changes, if found necessary, to the existing space and utili-

DISPLAY 72 Federal Obligations to Systems of Universities and Colleges for Research and Development, by Agency, Fiscal Year 1987, in Thousands of Dollars[1]

Systems of Universities and Colleges (Ranked by Total R & D Obligations)	Rank	Total	United States Department Agriculture	Commerce	Defense	Education	Energy	Environmental Protection Agency	Health & Human Services	Interior	NASA	National Science Foundation	Other[2]
Total, All Systems	–	$2,526,827	$129,957	$49,480	$301,412	$34,149	$149,375	$31,868	$1,274,423	$18,216	$123,485	$382,241	$32,221
Univ. of California System	1	668,937	12,441	6,242	67,359	3,584	36,261	3,199	378,224	2,810	33,754	112,956	4,107
Univ. of Texas System	2	234,892	582	184	41,689	360	8,607	1,027	155,743	484	9,182	17,025	9
Univ. of Wisconsin System	3	142,247	8,946	2,929	6,177	3,194	12,520	1,723	76,575	228	7,447	21,459	1,049
Univ. of Illinois System	4	136,213	7,448	1,343	21,183	2,768	12,074	1,643	44,027	460	2,865	39,318	3,084
Columbia Univ. System	5	132,349	0	278	8,675	368	5,814	346	88,098	1,018	3,346	21,996	2,410
Univ. of N. Carolina System	6	121,895	11,125	1,494	10,490	2,764	2,626	4,101	72,770	369	2,480	10,924	2,752
State Univ. of N.Y. System	7	104,514	525	2,173	6,776	1,011	4,372	2,757	63,660	195	2,086	20,929	30
State Univ. System of Florida	8	97,396	7,063	3,198	14,513	1,104	15,170	2,104	36,890	262	3,139	13,132	821
Univ. System of Georgia	9	91,012	7,546	1,258	34,705	172	10,617	858	20,328	499	2,620	10,397	2,012
Univ. of Maryland System	10	84,465	3,961	3,263	15,519	1,053	5,068	920	31,030	640	8,035	13,661	1,315
Utah Higher Educ. System	11	81,963	2,916	0	21,986	1,669	4,325	1,198	38,185	1,420	1,877	8,240	147
Univ. and St. Col. of Arizona	12	80,485	3,559	381	11,088	2,212	1,990	1,325	32,576	866	10,853	15,046	589
Oregon State H.E. System	13	77,650	8,528	3,288	8,158	4,791	1,196	2,344	31,128	1,594	1,224	13,904	1,495
Univ. of Alabama System	14	75,990	330	36	5,617	1,204	617	298	57,977	317	7,731	1,863	0
City Univ. of N.Y. System	15	54,074	100	0	1,358	2,145	2,201	224	41,800	0	804	5,334	108
Univ. of Tennessee System	16	42,610	4,572	0	3,605	686	9,149	451	19,363	256	958	2,886	84
Texas A&M Univ. System	17	41,401	11,494	2,471	6,336	10	3,643	667	6,557	119	2,634	6,704	766
Univ. of Hawaii System	18	39,558	3,895	9,418	1,552	1,043	1,336	25	6,543	757	4,615	8,809	1,565
Louisiana State Univ. System	19	37,392	3,851	2,161	2,670	295	1,434	710	22,151	552	470	3,048	50
Univ. of Missouri System	20	28,194	6,376	402	1,225	243	913	250	10,913	1,287	300	3,532	2,753
Univ. of Nebraska System	21	26,515	3,796	333	829	533	495	144	9,709	175	726	4,397	5,378
California St. Univ. System	22	20,988	415	267	5,032	152	1,602	345	5,576	129	2,790	4,780	0
Univ. of Alaska System	23	15,473	1,128	3,213	942	89	598	0	357	278	3,287	5,581	0
Univ. of Arkansas System	24	15,254	4,913	0	340	1,214	390	238	5,033	342	162	1,339	1,383
Univ. of Nevada System	25	14,955	1,624	1,244	260	0	2,100	3,205	2,704	1,500	287	2,031	0
Univ. of Houston System	26	13,458	76	50	1,201	133	1,258	252	3,479	0	3,481	3,454	74
Univ. of N. Hamp. System	27	13,116	1,582	2,598	332	0	355	25	572	105	5,204	2,343	0
Univ. of Puerto Rico System	28	10,624	4,179	770	316	36	419	0	3,133	113	217	1,440	1
Montana Univ. System	29	8,753	2,593	209	408	34	129	775	1,709	573	198	2,125	0
So. Illinois Univ. System	30	6,839	87	0	875	267	1,518	0	3,236	211	61	584	0

1. Includes obligations to every individual institution included within each system.
2. Includes the Department of Transportation, the Agency for International Development, the Department of Housing and Urban Development, the Department of Labor, and the Nuclear Regulatory Commission.

Source: National Science Foundation and University of California, Office of the President

DISPLAY 73 *Federal Obligations for Research and Development to the 50 Universities and Colleges Receiving the Greatest Funding by Agency, Fiscal Year 1987, in Thousands of Dollars*[1]

Institution (Ranked by Amount Received)	Rank	Total	United States Department			Education	Energy	Environmental Protection Agency	Health & Human Services	Interior	NASA	National Science Foundation	Other[2]
			Agriculture	Commerce	Defense								
Total, All Institutions	–	$4,723,730	$96,563	$34,661	$764,051	$25,108	$244,003	$26,980	$2,665,038	$16,029	$185,475	$628,678	$37,144
Johns Hopkins University	1	374,656	40	372	225,522	358	2,957	552	132,088	0	3,496	7,804	1,467
Stanford University	2	201,049	140	0	40,805	392	16,195	741	96,179	268	22,737	23,592	0
Mass. Inst. of Technology	3	187,623	411	2,072	45,397	248	44,323	290	45,949	788	12,069	33,710	366
University of Washington	4	164,891	2,173	4,218	22,985	1,912	6,415	1,091	98,459	456	4,046	23,136	0
Univ. of Calif., San Diego	5	151,768	150	5,942	23,672	191	3,915	72	68,452	552	9,644	40,078	9
Univ. of Calif., Los Angeles	6	147,795	136	0	12,922	185	13,891	872	98,361	126	5,449	15,453	400
University of Michigan	7	134,977	833	313	11,140	340	4,883	792	86,178	0	8,914	20,599	1,085
Univ. of Wisconsin, Madison	8	134,021	8,675	2,829	5,697	226	12,420	709	74,906	0	7,176	20,433	950
Yale University	9	132,909	414	0	9,697	285	7,781	200	103,543	0	656	10,333	0
Columbia University	10	130,724	0	75	8,675	195	5,814	346	87,315	1,018	3,346	21,530	2,410
Cornell University	11	128,695	8,509	46	14,321	146	4,678	1,468	60,678	280	3,696	34,278	595
Univ. of Calif., San Francisco	12	124,811	410	0	1,229	751	2,835	107	117,345	0	773	1,361	0
Harvard University	13	123,301	115	103	7,108	199	3,964	781	89,621	56	4,020	15,312	2,022
University of Minnesota	14	119,746	6,226	890	4,059	1,656	4,778	1,299	82,462	368	1,975	15,768	265
University of Pennsylvania	15	109,388	431	50	6,014	603	5,670	0	81,947	30	419	14,025	199
Univ. of Southern California	16	104,395	0	754	35,070	26	1,160	79	55,274	266	1,823	9,864	79
University of Illinois, Urbana	17	96,761	7,322	547	17,081	65	11,345	1,562	17,704	355	2,525	35,226	3,029
Univ. of Calif., Berkeley	18	96,748	7,303	61	12,310	471	3,428	471	34,335	414	13,250	24,304	401
Pennsylvania State University	19	94,615	7,071	560	40,862	204	2,700	655	23,849	3,557	3,970	10,601	586
Washington University	20	89,055	200	0	2,190	65	1,181	0	78,355	0	2,139	4,905	0
University of Colorado	21	87,623	205	9,122	6,067	192	3,097	411	43,652	663	10,439	13,753	2
University of Rochester	22	85,674	80	0	6,462	0	11,422	171	60,087	0	127	7,320	5
Duke University	23	84,622	100	116	3,479	0	2,447	1,513	70,600	0	747	5,620	0
University of Chicago	24	82,769	344	89	1,778	189	3,412	0	35,223	0	5,961	15,773	0
Univ. of N. Car., Chapel Hill	25	81,473	300	0	3,597	0	942	2,839	67,299	0	473	5,549	474
University of Texas, Austin	26	76,495	471	99	36,738	0	8,254	772	10,583	138	4,777	14,663	0
New York University	27	75,966	0	0	4,734	555	6,442	955	50,596	0	690	7,066	4,928
University of Pittsburgh	28	72,236	200	459	3,933	1,018	1,526	595	56,811	0	546	7,068	80
Carnegie-Mellon University	29	69,454	0	122	42,752	78	3,198	176	6,458	967	448	15,255	0
Yeshiva University	30	65,028	0	0	280	1,362	0	0	62,746	0	0	640	0
Ohio State University	31	64,573	7,025	661	9,130	18	2,847	511	24,057	303	2,924	8,761	8,336
University of Arizona	32	64,491	3,266	381	8,533	1,491	713	1,325	29,639	798	8,910	8,895	540
University of Iowa	33	63,479	75	11	3,246	450	255	771	48,965	140	6,315	3,251	0
Univ. of Ala., Birmingham	34	62,240	330	10	1,520	1,062	0	0	56,710	0	1,603	1,005	0
University of Massachusetts	35	57,913	2,734	0	11,424	466	1,491	311	31,194	62	912	9,319	0
Calif. Institute of Technology	36	57,122	0	90	9,440	0	5,476	573	11,920	1,200	6,662	21,761	0
Case Western Reserve Univ.	37	56,774	106	0	3,677	419	396	148	43,597	0	4,548	3,883	0
University of Utah	38	56,590	60	0	7,092	439	4,217	23	36,761	1,125	654	6,072	147
Baylor College of Medicine	39	56,255	4,867	0	494	1,172	0	178	48,901	0	309	334	0
Vanderbilt University	40	54,653	102	0	3,742	1,441	430	0	44,596	0	1,543	2,729	70
Boston University	41	53,331	56	95	3,898	1,421	925	10	41,714	30	513	4,660	9
Northwestern University	42	53,061	59	49	4,306	1,580	2,912	48	32,314	0	709	10,989	95
University of Florida	43	52,888	5,820	2,354	7,741	103	1,708	1,073	26,727	262	1,066	5,999	35
Univ. of California, Davis	44	50,289	3,509	0	1,616	682	4,213	181	28,121	1,259	1,231	6,794	2,683
Indiana University	45	50,005	201	0	2,053	0	6,123	468	27,815	139	402	12,804	0
University of Miami	46	49,547	0	1,077	3,965	301	235	0	35,675	0	733	7,489	72
Michigan State University	47	48,897	7,857	144	1,732	337	2,580	754	15,367	105	340	14,767	4,914
Univ. of Maryland, Coll. Park	48	48,728	2,510	845	13,484	952	4,994	845	3,745	61	7,875	12,522	895
Emory University	49	47,294	0	0	390	775	70	0	44,522	0	193	1,344	0
Purdue University	50	46,332	5,727	105	9,992	187	4,245	242	15,643	243	1,662	8,281	5
Univ. of California, Irvine	56	39,384	126	0	5,662	346	3,128	252	20,922	0	1,212	7,736	0
Univ. of Calif., Santa Barbara	75	27,322	3	0	8,923	642	2,720	708	3,661	116	1,428	8,498	623

1. Does not include federal support for special facilities such as the University of California's laboratories at Livermore and Los Alamos.

2. Includes the Department of Transportation, the Agency for International Development, the Department of Housing and Urban Development, the Department of Labor, and the Nuclear Regulatory Commission.

Source: National Science Foundation and University of California, Office of the President

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DISPLAY 74 *Research Laboratory Space Standards for the University of California as Recommended by the 1955 Restudy of the Needs of California in Higher Education*

Discipline	Assignable Square Feet per: FTE Faculty Member	FTE Graduate Student	Percentage for Service/Storage
Agriculture	300	200	10
Arts and Crafts	100	140	10
Engineering	300	200	15
Languages and Literature	40	30	5
Mathematics	60	30	5
Miscellaneous Professions[1]	80	30	10
Biological Sciences	250	160	10
Physical Sciences	250	160	10
Social Sciences	40	30	5

1. Education, Journalism, Librarianship, Social Welfare

Source: McConnell, 1955, p. 345, 348.

zation standards for the disciplines of engineering, biological sciences, and physical sciences to the Chairs of the legislative fiscal committees and the Joint Legislative Budget Committee (JLBC).

This language, of course, did not allow sufficient time for a comprehensive review of the subject, but the Commission reached some preliminary conclusions, which are summarized below:

1. Given the facts that [California's] last study of space standards for research laboratories was undertaken in 1955, and that California's standards are substantially divergent from those in other states, there is a strong probability that the current standards are outdated and in need of revision.
2. Although the data are limited, the available evidence indicates a need to liberalize the square footage allowances for faculty research laboratories in the natural sciences. There is a less compelling case for such liberalization in engineering. The area allowed for faculty members may be too stringent by only a small amount . . . , but once allowance is made for graduate students and postdoctoral fellows, there appears to be a need to increase California's allotment by a substantial amount.
3. Because most scientific research is now conducted by teams of researchers, rather than by individual faculty members with one or two graduate students, it is reasonable to institute space allocations for those additional people who now occupy faculty research laboratories. This should be done in two ways: (1) changes should be made in California's space guidelines to account for differences between beginning and advanced graduate students, and (2) the presence of postdoctoral fellows should be formally recognized in California's guidelines, since they are now such integral members of the University's scientific research teams.

The Commission went on to recommend interim changes in the standards of between 25 and 50 percent for natural science research laboratories, but no change in the standards for engineering.

Although the recommendations were not adopted, they did set the stage for the current study, and particularly for the work of MGT.

DISPLAY 75 *Existing Research Laboratory Space Standards for the University of California, with Standards Unchanged From the 1955 Restudy Shown in Boldface Type and Discipline Categories No Longer in Use Indicated by Strikeout*

Discipline	Academic FTE[1]	Assignable Square Feet per FTE Graduate Student: Lab	Office	Total[2]	Percentage for Service/Storage
Administration (B,D,I,LA,R)[3]	53	20.0	10.0	30.0	6.7
Agriculture:					
Agricultural Science (B,D,R)	300	185.0	15.0	200.0	10.0
Agricultural Economics (B,D)	53	0.0	30.0	30.0	6.7
Agricultural Biological Sciences (B,D)	275	165.0	15.0	180.0	10.0
Anthropology	145	80.0	15.0	95.0	7.5
Architecture, Environmental Design (B,D,LA)	100	130.0	10.0	140.0	10.0
~~Arts and Crafts~~	~~100~~			~~140.0~~	~~10.0~~
Arts, Performing[4]	100	125.0	15.0	140.0	10.0
Arts, Visual[4]	100	125.0	15.0	140.0	10.0
Biological Sciences	250	145.0	15.0	160.0	10.0
Computer Science (I,SB,SC)	180	100.0	15.0	115.0	10.0
Education (B,D,I,LA,R,SC)[5]	80	20.0	10.0	30.0	10.0
Engineering:					
Engineering Sciences (B,D,I,LA,SD)	300	185.0	15.0	200.0	15.0
Chemical Engineering (B)	275	165.0	15.0	180.0	12.5
Agricultural Engineering (D)	500	285.0	15.0	300.0	15.0
Foreign Languages[6]	40	0.0	30.0	30.0	5.0
Geography (B,D,I,LA,SB)	145	60.0	35.0	95.0	7.5
International Relations (SD)	80	20.0	10.0	30.0	10.0
Journalism[5] (B)	80	0.0	30.0	30.0	10.0
~~Languages and Literature~~	~~40~~			~~30.0~~	~~5.0~~
Law[5] (B,D,LA)	80	25.0	5.0	30.0	10.0
Letters[6]	40	0.0	30.0	30.0	5.0
Library Sciences[7] (B,LA)	80	20.0	10.0	30.0	10.0
Mathematics	60	0.0	30.0	30.0	5.0
Physical Sciences	250	145.0	15.0	160.0	10.0
Psychology	145	80.0	15.0	95.0	7.5
~~Miscellaneous Professions~~[8]	~~80~~			~~30.0~~	~~10.0~~
Social Ecology (I)	145	80.0	15.0	95.0	7.5
Social Sciences	40	0.0	30.0	30.0	5.0
Social Welfare[5] (B,LA)	40	20.0	10.0	30.0	5.0
Speech (SB)	70	62.5	22.5	85.0	7.5
Studies, Applied Behavioral (D)	125	35.0	15.0	50.0	10.0
Studies, Creative (SB)	0	0.0	30.0	30.0	5.0
Studies, Environmental (SB,SC)	145	60.0	35.0	95.0	7.5
Studies, Interdisciplinary (B,LA,SD)	40	0.0	30.0	30.0	5.0

1. Academic FTE = Budgeted faculty FTE plus teaching assistant FTE.
2. After the *Restudy*, standards for graduate students were split into research and office space allowances.
3. B = Berkeley; D = Davis; I = Irvine; LA = Los Angeles; R = Riverside; SD = San Diego; SB = Santa Barbara; SC = Santa Cruz. Where a campus is not indicated for a particular discipline, it means that it is offered on all campuses.
4. Formerly under "Arts and Crafts."
5. Formerly under "Miscellaneous Professions."
6. Formerly under "Languages and Literature."
7. Formerly "Librarianship" under "Miscellaneous Professions."
8. "Miscellaneous Professions" include education, journalism, law, librarianship, and social welfare.

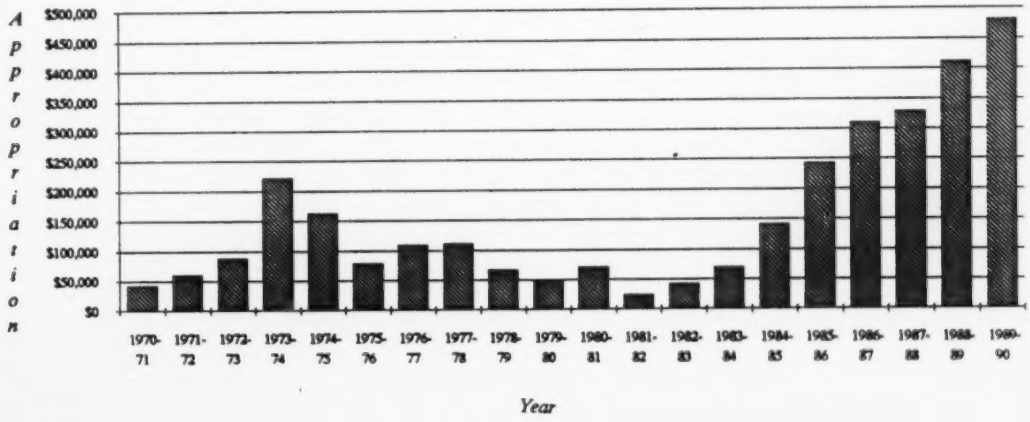
Source: University of California, Office of the President, May 1986

DISPLAY 76 *State Capital Outlay Appropriations for California Higher Education, 1970-71 to 1989-90, in Thousands of Dollars*

Year	University of California	California State University	California Community Colleges	Total
1970-71	$11,853	$14,520	$15,963	$53,262
1971-72	0	19,501	41,059	60,904
1972-73	20,856	39,459	28,246	59,935
1973-74	68,698	76,936	76,562	208,658
1974-75	68,210	47,236	47,067	139,352
1975-76	37,264	22,949	18,368	74,002
1976-77	38,675	34,132	36,148	115,355
1977-78	44,627	28,647	37,902	106,699
1978-79	26,293	23,873	17,054	87,025
1979-80	19,706	21,083	7,584	44,418
1980-81	38,642	21,792	10,174	78,596
1981-82	10,426	10,625	3,749	32,654
1982-83	14,511	18,803	9,167	36,453
1983-84	49,544	13,359	7,483	24,656
1984-85	110,394	25,176	6,517	163,395
1985-86	141,295	54,800	46,320	216,674
1986-87	159,193	111,793	39,246	348,770
1987-88	142,409	136,574	49,958	315,263
1988-89	186,753	111,973	112,722	636,386
1989-90	188,008	182,408	111,105	470,795

Source: State of California Governor's Budgets and Final Budget Acts, 1972-73 through 1989-90.

DISPLAY 77 Total State Capital Outlay Appropriations for California's Three Public Segments of Higher Education, 1970-71 Through 1989-90, in Thousands of Dollars



Source: Display 76.

Results of the national survey

The space formulas for research laboratories were the most complex of any of the four types of space considered by MGT in the national survey. The formulas used nationally for offices, classrooms, and teaching laboratories were relatively consistent, particularly for the latter two, since most other states had already adopted California's space factor formula that was developed in the 1960s by the Coordinating Council. Because of that, it was relatively easy to insert numbers into various parts of the formula to derive true comparisons. While problems did develop in such areas as the definition of full time equivalency and the number of hours to which a particular utilization standard would be applied, all of these were solved by the normalization process that produced the prototype institutions' norms.

With research space, the problem of normalization was complicated by the fact that there is no nationally recognized formula for determining laboratory sizes. Unlike the other spaces considered earlier by the advisory committee, research areas are used by individuals with many different functions and are funded from a variety of sources. Where classrooms are occupied only by faculty and students funded from State appropriations, research laboratories and related areas are occupied by regular faculty, research faculty, visiting and emeriti faculty, research assistants, research technicians, postdoctoral fellows, and various levels of both undergraduate and graduate students. In addition, there is rarely a single funding source for these personnel as some are State funded while others derive their support from contracts and grants; many use both internal and external sources. At the very least, the following list describes the types of individuals engaged in university research activities:

State-Funded Personnel	Externally Funded Personnel
FTE Faculty	FTE Research Faculty
FTE Graduate Students:	
Graduate I	
Graduate II	
FTE Research Assistants	FTE Research Assistants
FTE Research Technicians	FTE Research Technicians
FTE Postdoctoral Fellows	FTE Postdoctoral Fellows

Appendix C shows how the different state formulas work. The number of assignable square feet shown in the display is derived from the weighted averages shown in Volume II of the national survey.

Not only do research personnel derive their support from both internal and external sources, various states also use very different internal budgeting methods. The great differences in their space for-

mulas and budgeting techniques made it impossible to use a single system for all states and necessitated a division of the prototype into two categories -- the first including those states that budget virtually all faculty from state funds, and the second including those that maintain a separate contract and grant budget. (In one case -- Virginia -- it was necessary to use elements of both methods.) In each division, the total number of personnel is the same.

Each state surveyed used a different set of standards to determine total research space allowances, and it was necessary to reconcile these differences in a disciplinary "crosswalk." Once this was accomplished, the formulas could be applied to the appropriate budgeting system to produce a total number of assignable square feet for each state that was comparable to the amount generated by California's standards. The formulas were detailed by MGT in Volume I of its national survey (MGT, 1989a, pp. 162-167, 203). Display 78 presents the national comparison, with Display 79 on page 108 showing the calculations that produced the national and California totals.

Constructing new research space standards

As noted above, various states use a wide variety of methods to calculate appropriate levels of research space. Some employ only state-funded faculty and graduate students; others count all researchers from whatever funding source; still others make calculations to account for differences in research and teaching time; a few count technicians and assistants; and about a third count postdoctoral fellows. In some cases, such as Ohio and Wisconsin, the budgeting formulas are so complex that it is impossible to determine the number of square feet they generate, while in others, such as New Hampshire and Utah, the formulas are relatively simple. A few states have considered the idea of basing research space only on the total amount of research funding received, but no state has yet adopted this approach.

The University of California standards

In developing new standards for the University of California, it was necessary to take into account the fact that the existing standards have not been used for many years. So much has changed since the 1950s in the ways that universities conduct research and in their space requirements for equipment and health and safety that when funding for new construction became available in the early- to mid-1980s, it became apparent that the 1955 *Restudy* standards would be entirely inadequate as a basis for determining current needs. Because of that, the University based its capital requests not on the existing standards, but on assessments of program need, with each project individually justified and approved by the Governor and the Legislature.

To determine viable and workable space standards for research laboratories that could be applied to future budget requests, the University examined all Project Planning Guides (PPG) that were approved for funding over the past eight years. Then, following the principle used earlier for teaching laboratories -- that of grouping disciplines into as few categories as possible -- it sought to determine various "breaking points" that would permit all of the discipline categories used by MGT for the national survey to be arrayed into groups. That process produced the six categories shown in Display 80 on page 109 and discussed below.

The next task was to determine square footage allowances for the key individuals who actually use research laboratories. At the University, as at most research universities, these include faculty, graduate students, and postdoctoral fellows -- the latter particularly in the sciences. Although there are various other subsets of research laboratory personnel, such as laboratory technicians and assistants, and visiting or emeriti faculty, developing individual standards for such individuals would violate a basic principle that has governed this study from the outset -- that the new standards should be as simple in concept and as easy to administer as possible. This principle also militates against making additional distinctions between research and teaching faculty, or between first- and second-stage graduate students (a change from the Commission's preliminary thought in *Time and Territory*), since even if a clean analytical method could be devised to determine space allocations for them, which is doubtful, such a method would offer few benefits and might also offer highly undesirable incentives to place certain individuals in categories that generate more space.

DISPLAY 78 *Assignable Square Feet of Research Laboratory Space Generated by the Surveyed State Formulas for the Prototype Research University*

State	ASF for State Funded Programs[a]	ASF for Contract and Grant Programs[a]	Total ASF for all Programs	
Colorado	2,266,668	32,375	2,299,043	
Florida	3,296,294	285,798	3,582,092	
Kansas	3,595,047	790,020	4,385,067	
Maryland	4,457,319	66,395	4,523,714	
Nebraska	5,149,512	55,300	5,204,812	
New Hampshire	3,644,585	324,444	3,969,029	
Ohio	[c]	[c]	[c]	
Ontario	3,574,988	293,156	3,868,144	
Oregon	1,944,835	78,520	2,023,355	
Utah	5,134,560	236,460	5,371,020	
Virginia	3,288,273	239,085	3,527,358	
Wisconsin	[c]	[c]	[c]	
Mean (Excluding California)	3,635,208	240,155	3,875,363	
Median (Excluding California)	3,585,018	237,773	3,918,587	
California	**3,098,246[b]**	**N/A**	**3,098,246[b]**	Rank 9/11

a. Calculated by applying weighted average space factor values (Exhibits 6.14 to 6.24) to prototype characteristics in accordance with each state's formula outlined in Section 6.1.

b. California's total ASF for research lab space, 3,472,859, has been reduced by 374,613; the average graduate teaching lab space generated by other states' standards. California must use research lab space for scheduled graduate teaching labs. The full range of space factors for other states are presented in Exhibit 5.4.3 and discussed in Section 5.5.

c. Cannot be computed.

Source: MGT Consultants, 1989a, p. 203

The existing research laboratory standards are based on three factors: (1) assignable square feet per State-supported faculty member, (2) assignable square feet per graduate student, and (3) a percentage adjustment for service and support areas. As with other space types considered in this project, the final element of the standard -- support space -- has been subsumed into the overall assignable-square-feet figures. Such inclusion not only simplifies the process of administering the standards, it also affords campus planners greater flexibility to determine actual program needs.

DISPLAY 79 *Analysis of the Existing Research Laboratory Space Standards for the University of California*

Discipline	Discipline Weight	ASF per Faculty	Graduate Student Proportion	ASF per Graduate Student	% Add on for Support Space
Administration	0.028	53.0	0.087	20.0	6.7%
Agric. Biological Sciences	0.013	275.0	0.009	165.0	10.0%
Agricultural Economics	0.007	53.0	0.005	0.0	6.7%
Agricultural Science	0.067	300.0	0.044	185.0	10.0%
Anthropology	0.017	145.0	0.017	80.0	7.5%
Architecture (Environ. Design)	0.015	100.0	0.028	130.0	10.0%
Arts, Performing	0.046	100.0	0.034	125.0	10.0%
Arts, Visual	0.026	100.0	0.015	125.0	10.0%
Biological Sciences	0.070	250.0	0.053	145.0	10.0%
Computer Science	0.007	180.0	0.004	100.0	10.0%
Education	0.021	80.0	0.078	20.0	10.0%
Engineering Sciences	0.093	300.0	0.147	185.0	15.0%
Engineering, Agriculture	0.001	500.0	0.001	285.0	15.0%
Engineering, Chemical	0.003	275.0	0.006	165.0	12.5%
Foreign Languages	0.062	40.0	0.029	0.0	5.0%
Geography	0.008	145.0	0.006	60.0	7.5%
International Relations	0.000	80.0	0.000	20.0	10.0%
Journalism	0.001	80.0	0.003	0.0	10.0%
Law	0.016	80.0	0.090	25.0	10.0%
Letters	0.126	40.0	0.066	0.0	5.0%
Library Sciences	0.003	80.0	0.013	20.0	10.0%
Mathematical Sciences	0.065	60.0	0.032	0.0	5.0%
Physical Science	0.112	250.0	0.097	145.0	10.0%
Psychology	0.038	145.0	0.021	80.0	7.5%
Social Ecology	0.005	145.0	0.003	80.0	7.5%
Social Sciences, General	0.129	40.0	0.091	0.0	5.0%
Social Welfare	0.004	40.0	0.016	20.0	5.0%
Speech	0.000	70.0	0.000	63.0	7.5%
Studies, Applied Behavioral	0.002	125.0	0.002	35.0	10.0%
Studies, Creative	0.000	0.0	0.000	0.0	5.0%
Studies, Environmental	0.003	145.0	0.002	60.0	7.5%
Studies, Interdisciplinary	0.012	40.0	0.001	0.0	5.0%
Total	**1.000**		**1.000**		
Unweighted Average		**148.7**		**80.8**	
Weighted Average		**155.6**		**89.2**	

Total ASF Generated:	3,472,859	From MGT National Survey, Volume I, p. 203 (note b)
Less Allowance for Graduate Teaching Laboratories:	374,613	From MGT National Survey, Volume I, p. 203 (note b)
Net ASF:	3,098,246	3,472,859 - 374,613
National Mean ASF:	3,875,363	From MGT National Survey, Volume I, p. 203
National Mean Exceeds Existing Standards by:	25.1%	((3,875,363 ÷ 3,098,246) - 1) × 100

Source: MGT 1989b, and Commission Staff

DISPLAY 80 Revised University of California Research Space Standards

Category	Description	ASF per State Supported FTE Faculty[1]	ASF per Graduate Student[1]	ASF per Postdoctoral Fellow[1]
I	Complex wet and dry laboratories, typically assigned to research teams. High density of utility services, fume hoods, other built-in equipment, bench space, and movable equipment. Requires service areas and support space ranging from 25 to 50% of core laboratories.	500	250	250
II	Laboratories generally requiring fewer laboratory services and less bench space for individual work stations. Greater proportion of core laboratories shared among research teams, often housing bulky experimental apparatus. Requires service areas and support space ranging from 10 to 25% of core laboratories. Faculty and graduate students also involved in field research.	350	175	175
III	Large individual studios for faculty and graduate student creative activity, usually occurring on a solo basis. Specialized support areas required for specific equipment-based techniques, such as photography, computing arts, or media editing.	500	250	250
IV	Small individual studios, and shared rehearsal facilities, production studios and project areas. Accommodates both solo and group activities. Specialized facilities often used on a shared basis for teaching, research, and performance activities. Special storage facilities required.	150	150	150
V	Combination office – and laboratory – based research activities. Laboratories, project rooms, or observational/practice facilities often are shared among several research teams. Limited service areas with some special storage needs.	150	100	100
VI	Office-based research activities requiring computer support, group project rooms, reading/study areas. Limited service and support needs.	50	50	50

1. Space allowances per faculty, graduate student, and postdoctorate include all service and support space.

Source: University of California, Office of the President; and Commission Staff

The new standards also contain three elements, but all of them are based on actual research personnel:

1. *State-Funded Faculty:* The practice of considering only State-funded faculty has been continued, even though every other state surveyed also counts non-state funded "Contract and Grant" faculty in determining its space allocations. In part, this has been done because of the ease of determining the number of State-funded personnel, and also because the number tends to be relatively stable over the long run, thus permitting greater planning consistency.

2. *Graduate Students:* The second element is graduate students. In the 1950s, it was assumed that there would be a single allowance to accommodate both graduate student research areas and graduate student offices. In the intervening years, this practice was discontinued in favor of one that separated research and office spaces. When the advisory committee considered office areas at an earlier meeting, it was decided to remove graduate students from the office allowance and to include them under an inclusive "research space" category. This has been done in the current proposal, with an adjustment included to reflect the change (see the bottom of Display 81).

3. *Postdoctoral Fellows:* The proposed new standard includes postdoctoral students for the first time -- and at the same space-per-full-time-equivalent rate as graduate students.

One of the most significant changes that has occurred in universities since the 1950s is the enormous increase in research funding, and with it, the emergence of postdoctoral fellows as major participants in university research activities. In *Time and Territory*, the Commission presented a table showing the growth in research funding since 1950-51, which is repeated and updated in Display 82 on page 112, and it also noted the following facts about postdoctoral fellows (1986a, pp. 53, 55):

> Of particular importance in the development of research teams are postdoctoral fellows whose existence is not recognized in any California space standards but who nevertheless occupy scientific laboratory space and perform a large amount of the work. According to a 1983 survey . . . , 617 American universities reported employing 20,829 postdoctorals that year, virtually all of them (99.8 percent) at doctorate-granting institutions. The National Science Foundation's estimate for the total number was about 23,000. In addition, there were another 5,000 "non-faculty research staff" who also held a doctoral degree but were not formally placed in the postdoctoral fellow category. Research technicians were not listed.
>
> Among the postdoctorates, 70.3 percent were employed in five fields: biological sciences (38.8 percent); physical sciences (20.2 percent); engineering (6.8 percent); environmental sciences (2.8 percent); and mathematics/computer sciences (1.7 percent). The only other field employing large numbers of postdoctoral researchers was the health sciences (23.3 percent).
>
> The National Science Foundation also ranked universities according to their use of postdoctorates in 1983. It indicates that the University of California received 8.7 percent of all the research and development money expended nationally from all sources and for all purposes in 1983 and employed 12.8 percent of all postdoctoral fellows. Five University campuses ranked in the top 20 nationally in research funds received, and eight of the nine in the top 100. Only Santa Cruz fell outside that category, ranking 137th of the 617 reporting institutions.

In spite of their integral role in the research function at major universities, postdoctoral fellows are not a well-recognized group. In his Godkin Lectures at Harvard in 1963, Clark Kerr referred to them as "the unfaculty." Little data concerning their numbers or activities were collected prior to 1971 when the National Science Foundation formally included them in their surveys, but the National Academy of Sciences in 1969 chronicled their history in *The Invisible University: Postdoctoral Education in the United States*. According to that study, the definition of postdoctoral is difficult but includes:

> Appointments of a temporary nature at the postdoctoral level that are intended to offer an opportunity for continued education and experience in research, usually, though not necessarily, under the supervision of a senior mentor. The appointee may have a research doctorate (e.g., Ph.D., Sc.D.) or professional doctorate

DISPLAY 81 *Analysis of the Proposed Research Laboratory Space Standards for the University of California, with a Comparison to the Existing Standards*

Discipline	Discipline Weight	ASF per Faculty	Graduate Student Proportion	ASF per Graduate Student	Postdoctoral Fellow Proportion	ASF per Postdoctoral Fellow	% Add on for Support Space
Administration	0.028	50.0	0.087	50.0	0.000	50.0	0.0%
Agric. Biol. Sciences	0.013	500.0	0.009	250.0	0.000	250.0	0.0%
Agricultural Economics	0.007	50.0	0.005	50.0	0.000	50.0	0.0%
Agricultural Science	0.067	350.0	0.044	175.0	0.076	175.0	0.0%
Anthropology	0.017	150.0	0.017	100.0	0.000	100.0	0.0%
Architecture (Environ. Design)	0.015	150.0	0.028	150.0	0.000	150.0	0.0%
Arts, Performing	0.046	150.0	0.034	150.0	0.000	150.0	0.0%
Arts, Visual	0.026	500.0	0.015	250.0	0.000	250.0	0.0%
Biological Sciences	0.070	500.0	0.053	250.0	0.424	250.0	0.0%
Computer Science	0.007	150.0	0.004	100.0	0.010	100.0	0.0%
Education	0.021	50.0	0.078	50.0	0.000	50.0	0.0%
Engineering Sciences	0.093	350.0	0.147	175.0	0.105	175.0	0.0%
Engineering, Agriculture	0.001	500.0	0.001	250.0	0.000	250.0	0.0%
Engineering, Chemical	0.003	500.0	0.006	250.0	0.000	250.0	0.0%
Foreign Languages	0.062	50.0	0.029	50.0	0.000	50.0	0.0%
Geography	0.008	150.0	0.006	100.0	0.000	100.0	0.0%
International Relations	0.000	50.0	0.000	50.0	0.000	50.0	0.0%
Journalism	0.001	50.0	0.003	50.0	0.000	50.0	0.0%
Law	0.016	50.0	0.090	50.0	0.000	50.0	0.0%
Letters	0.126	50.0	0.066	50.0	0.000	50.0	0.0%
Library Sciences	0.003	50.0	0.013	50.0	0.000	50.0	0.0%
Mathematical Sciences	0.065	50.0	0.032	50.0	0.017	50.0	0.0%
Physical Science	0.112	500.0	0.097	250.0	0.293	250.0	0.0%
Psychology	0.038	150.0	0.021	100.0	0.026	100.0	0.0%
Social Ecology	0.005	150.0	0.003	100.0	0.000	100.0	0.0%
Social Sciences, General	0.129	50.0	0.091	50.0	0.049	50.0	0.0%
Social Welfare	0.004	50.0	0.016	50.0	0.000	50.0	0.0%
Speech	0.000	150.0	0.000	100.0	0.000	100.0	0.0%
Studies, Applied Behavioral	0.002	50.0	0.002	50.0	0.000	50.0	0.0%
Studies, Creative	0.000	50.0	0.000	50.0	0.000	50.0	0.0%
Studies, Environmental	0.003	150.0	0.002	100.0	0.000	100.0	0.0%
Studies, Interdisciplinary	0.012	50.0	0.001	50.0	0.000	50.0	0.0%
Total	**1.000**		**1.000**		**1.000**		
Unweighted Average		**181.3**		**112.5**		**112.5**	
Weighted Average		**213.2**		**118.9**		**217.8**	

National Mean Assignable Square Feet (ASF):	3,875,363	From MGT National Survey, Volume I, p. 203
California ASF Generated by Existing Standards:	3,098,246	From MGT National Survey, Volume I, p. 203
National Mean ASF Exceeds California Existing ASF by:	25.1%	((3,875,363 ÷ 3,098,246) - 1) × 100
California Gross ASF Generated by New Standards:	4,669,120	(213.2 × 7,600) + (118.9 × (17,126 + 8,550)) + (217.8 × 1,700)
Less Deduction for Graduate Student Office Space:	647,035	From MGT National Survey, Volume I, p. 226
Net California ASF Generated by New Standards:	4,022,085	4,669,120 - 647,035
National Mean ASF Exceeds California's New ASF by:	-3.6%	((3,875,363 ÷ 4,022,085) - 1) × 100
California's New ASF Exceeds National Mean ASF by:	3.8%	((4,022,085 ÷ 3,875,363) - 1) × 100
California's New ASF Exceeds Existing ASF by:	29.8%	((4,022,085 ÷ 3,098,246) - 1) × 100

Source: MGT, 1989b, and Commission Staff

DISPLAY 82 *University of California Expenditures from Extramural Funds, Five-Year Intervals Beginning in 1950-51, in Current Dollars*

Year	Total Expenditures from Extramural Funds[1] In Current Dollars	In 1988 Dollars	Ladder Rank Faculty FTE[2]	Total Expenditures from Extramural Funds per Faculty FTE In Current Dollars	In 1988 Dollars
1950-51	$3,334,208	$16,336,149	2,375[3]	$1,404	$6,878
1955-56	7,355,156	32,387,301	3,643[3]	2,019	8,890
1960-61	46,191,764	180,718,952	3,116	14,824	57,997
1965-66	120,378,562	426,269,696	4,097	29,382	104,044
1970-71	207,180,910	583,608,197	5,988	34,599	97,463
1975-76	337,852,914	669,413,343	5,924	57,031	113,000
1980-81	591,486,798	780,531,536	6,186	95,617	126,177
1985-86	776,100,000	828,547,027	6,639	116,900	124,800
1987-88	925,700,000	925,700,000	6,734	137,467	137,467

1. Dollar figures do not include expenditures from Atomic Energy Commission or Department of Energy sources.
2. Ladder-rank faculty FTE include Full, Associate, and Assistant Professors plus Instructors.
3. Faculty FTE for 1950-51 and 1955-56 are estimated, by applying the average FTE/headcount ratio for the other years to actual headcount for those two years.

Sources: University of California. *University of California Financial Report*: 1950-51, 1955-56, 1960-61, 1965-66, 1985-86, and 1987-88. *University of California Report on Activities Financed Through Contracts and Grants from Extramural Sponsors*: 1970-71, 1975-76, 1980-81, and 1983-84. *University of California Statistical Summary of Students and Staff*: 1950-51 through 1987-88.

(e.g., M.D., D.V.M.) or other qualifications which are considered equivalent under the circumstances. A person may have more than one postdoctoral appointment during his career (California Postsecondary Education Commission, 1986a, pp. 55, 57).

The Commission went on to note that:

> During field investigations undertaken in conjunction with this report, Commission staff spoke with a number of postdoctoral researchers and their faculty supervisors at the San Diego and Santa Cruz campuses of the University, and from those discussions, it emerged that the closest parallels to postdoctoral research activity are probably medical internships and residencies, and legal clerkships. In engineering and the sciences today the work has become so complex, and the educational requirements for researchers so great, that virtually no scientific investigator can receive a faculty appointment without three to six years of postdoctoral experience. Today, the normal track to a professorship in the sciences involves seven or eight years of formal education culminating in the Ph.D. or comparable degree plus another three or more as a postdoctoral. It is often the case as well that a faculty appointment cannot be secured until postdoctoral interns have demonstrated their proficiency in the field by publishing the results of their research and securing grants in their own names (ibid, p. 58).

Chancellor Richard Atkinson of the University's San Diego campus, who previously was the director of the National Science Foundation, may be uniquely qualified to speak on this subject. In a 1985 letter

to University of California President David Gardner, he discussed the issue:

> The nature of post-doctoral education and its importance to California is not widely understood. The complexity and sophistication of many fields in science and engineering has grown to a level where training beyond completion of a doctoral program is required before a researcher can function independently. A system has evolved whereby young scientists and engineers serve an apprenticeship as post-doctoral fellows for several years before assuming tenure-track positions in universities or their equivalent in government or industry research laboratories. The University of California, because of the excellence of its programs, has proved to be an attractive environment for "post-docs." Consequently, the University attracts to the State many outstanding young scientists and engineers who as trainees make significant contributions to the University's research and graduate programs. Many of these talented individuals take up permanent residence to pursue careers in California's businesses and universities. Without strong programs of post-doctoral education, the State would be seriously handicapped in its effort to maintain a rapid pace of industrial development in agriculture, electronics, bio-technology, and the many other fields which are critically dependent on the availability of highly trained personnel.
>
> Since virtually all post-docs either bring their own support in the form of competitively-won fellowships or are employed on extramurally-funded contracts and grants, they do not impose a direct financial burden on the University or the State. Since post-docs do, however, occupy space, the University must make room for them in laboratories and offices. The space standards which guide the University's capital outlay program, however, make no provision whatsoever for this need. As a result, the facilities available for research, graduate education, and post-doctoral training are inadequate. In the past, the University has been able to overcome this deficiency because of the quality of its faculty and the general attractiveness of California to people beginning a career. To some extent, it will be able to continue to do so in the future. But as other states and their universities have begun to respond to the lure of "high-tech" by making major commitments to develop outstanding research facilities, we cannot count on being able to get by with marginal or inadequate research facilities.

When it was developing the data for the national survey of space standards, MGT was advised by the University that about 1,700 postdoctoral fellows were in residence at the University's campuses. Subsequent research has provided a delineation of the disciplines in which those postdoctoral fellows are currently engaged in research; and, as can be seen in Display 83, they are heavily concentrated in the sciences and engineering.

The proposal for research-space standards delineated in Displays 80 and 81 indicate the six general categories and how each of the discipline categories used by MGT to develop the national survey are affected by the proposal. Display 81 provides a complete data array and a comparison of the total assignable square feet generated by the new standards in comparison to both the University's existing standards and the national mean for the surveyed states. In each case, the square footages proposed are based on an actual review of legislatively approved Project Planning Guides, and do not represent an increase from the space totals currently under construction or soon to be under construction. In that sense, while the proposed standards represent a substantial increase from the *Restudy* standards of 1955, they do not represent an increase from current practice. It should also be noted that the proposed standards do not represent a significant departure from existing national practice, since they exceed the national mean by only 3.8 percent. Given the facts that the quality of the data from other states and the complexity of their formulas make a precise determination of national standards impossible, such a difference is probably within a reasonable margin of error for the national mean itself.

The California State University standards

The remaining item to consider is research space standards for the California State University. Based on a 1966 agreement with the Department of Finance, the State University can receive research space for full-time-equivalent graduate students at

DISPLAY 83 Distribution of University of California Postdoctoral Fellows[1]

Discipline	Number[2]	Percentage	Space Category[3]
Biological Sciences	720	42.4%	I
Physical Sciences	498	29.3	I
Engineering	179	10.5	II
Agriculture	130	7.6	II
Psychology	44	2.6	V
Computer Science	17	1.0	V
Mathematics	29	1.7	VI
Social Sciences	83	4.9	VI

1. Based on 1,700 postdoctoral fellows in the prototype university system developed by MGT.
2. Distribution of postdoctoral fellows by discipline is based on a Fall 1987 *Survey of Graduate Science and Engineering Students and Postdoctorates* conducted by the National Science Foundation, with data reported by discipline by each of the University of California campuses.
3. See Display 104 for space categories.

Source: University of California, Office of the President

a rate equal to 75 percent of the University of California's graduate research space allowance for both offices and laboratories, provided each project is individually justified. A full-time-equivalent graduate student is defined for this purpose as a master's degree level student carrying an eight-unit load. For support budget purposes, a full-time-equivalent graduate student is defined as 15 units of work. No research allowance is provided in this agreement for faculty members.

In the focus-group discussions conducted by MGT, faculty members and administrators repeatedly noted that graduate students are increasingly involved in research projects. Many campuses now require the completion of formal projects as a requirement for graduation -- in some cases even from undergraduate students. Like the University of California, this is particularly true in the sciences and engineering. Because of this, it seems prudent not only to continue the informal agreement, but to formalize it as a permanent feature of the space standards.

7 *Faculty Offices*

ALLOWANCES for academic administrative offices at the University of California and the California State University were established in 1955 by the *Restudy*, confirmed in 1960 by the Master Plan Survey Team, and reconfirmed in 1966 by the Coordinating Council for Higher Education. For the community colleges, the present standard for both academic and central administrative space was formulated in 1966 by the Council.

Over the past quarter century, many of the circumstances that led to the establishment of the existing standards have changed, including (1) the revolutionary expansion of technology, including xerographic equipment, personal computers, and fax machines; (2) a greater and growing emphasis on faculty/student contact; (3) an explosion in literature; and (4) a need for a greater number of administrative and support staff for special services and research programs. In addition, and particularly at the University of California, what was at one time a clear distinction between offices and laboratories has become blurred. At the California State University, a growing imperative toward instructionally related research and publication has unquestionably created strains on the office space currently available to faculty. In the community colleges, the Commission for the Review of the Master Plan for Higher Education and the Legislature's Joint Committee for Review of the Master Plan have urged greater contact between both full- and part-time faculty members and students -- a trend that has expanded office space needs.

The fact that California's office space standards have not been updated since 1966 was reflected in the national survey conducted by MGT. Its 1988-89 data indicated that the standards used by community colleges in other states generate 57.3 percent more office space than those in California, and comparable analyses of the California State University and the University of California show percentages of 31.4 and 4.9, respectively (Displays 84 through 89). Since virtually every state surveyed has reviewed its standards more recently than California, this should not be surprising.

Other major responsibilities assumed by MGT were to determine how the academic environment has changed in the past 20 to 30 years and how those changes have impacted space requirements. During meetings of the focus groups, a consistent theme expressed by faculty members was a lack of space to house equipment (especially personal computers) as well as to store both written materials and computer software, consult with and advise students, confer with colleagues, and secure a degree of privacy.

As a result of the data accumulated by MGT, the views expressed in the focus groups, and conversations with members of the Commission's Advisory Committee on Space and Utilization Standards, it is clear that a number of changes in faculty office space standards should be made, particularly in the community colleges, with lesser increases for the University of California and the California State University.

A change proposed by the Commission for all three segments is the integration of several categories of space into a single allowance by combining the existing allowances for faculty offices, related administrative space, and service/storage areas. This consolidation will not only bring California into line with commonly used practices elsewhere, where such spaces are normally combined into a single figure, but also permit far simpler budgetary calculations that should encourage planning flexibility. A major outcome of the focus-group discussions was the determination that not all disciplines have identical office needs. It is equally clear that planning for those needs should be done by those closest to them -- by campus and systemwide planners who are most familiar with specific disciplinary and departmental requirements. Accordingly, the Commission proposes that a single number be adopted and -- for reasons outlined below -- that this number be different for each segment.

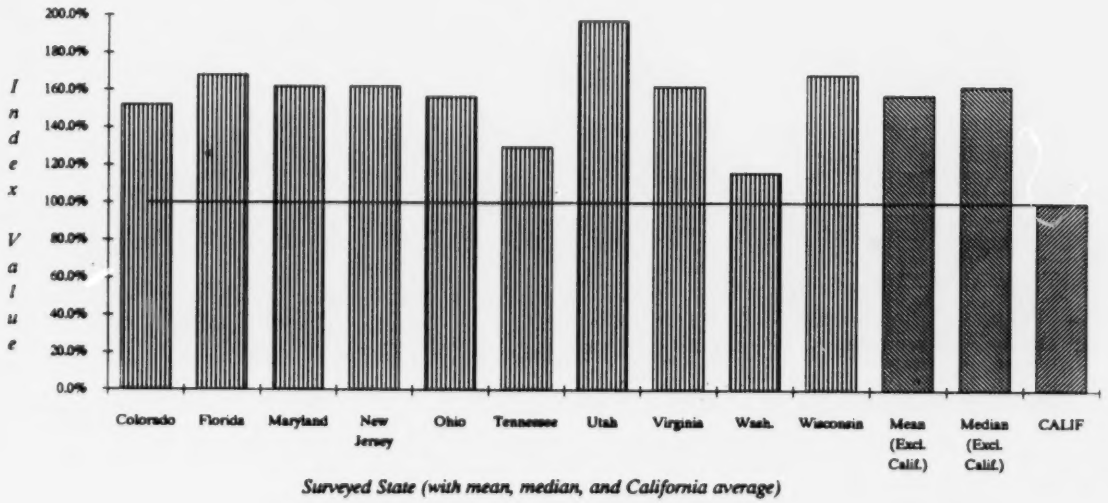
California has a long-established principle of differentiation of function, which plays a prominent role in the faculty office space standards proposed in this report. It is clear from the accumulated evidence

DISPLAY 84 *Assignable Square Feet of Academic Office Space Generated by the Surveyed State Formulas for the Prototype Community Colleges*

State	Total ASF for All Positions	Percentage by Which Total ASF Exceeds California
Colorado	4,149,000	52.1%
Florida	4,579,680	67.9
Maryland	4,421,760	62.1
New Jersey	4,421,760	62.1
Ohio	4,263,840	56.3
Tennessee	3,536,156	29.6
Utah	5,369,280	96.8
Virginia	4,421,760	62.1
Washington	3,158,400	15.8
Wisconsin	4,579,680	67.9
Mean (Excluding California)	**4,290,132**	**57.3%**
Median (Excluding California)	**4,421,760**	**62.1%**
California	**2,727,735**	**N/A**

Source: MGT, 1989a.

DISPLAY 85 *Indexed Comparison of California Community College Office Space Standards with Those in Other States*



Source: Display 84.

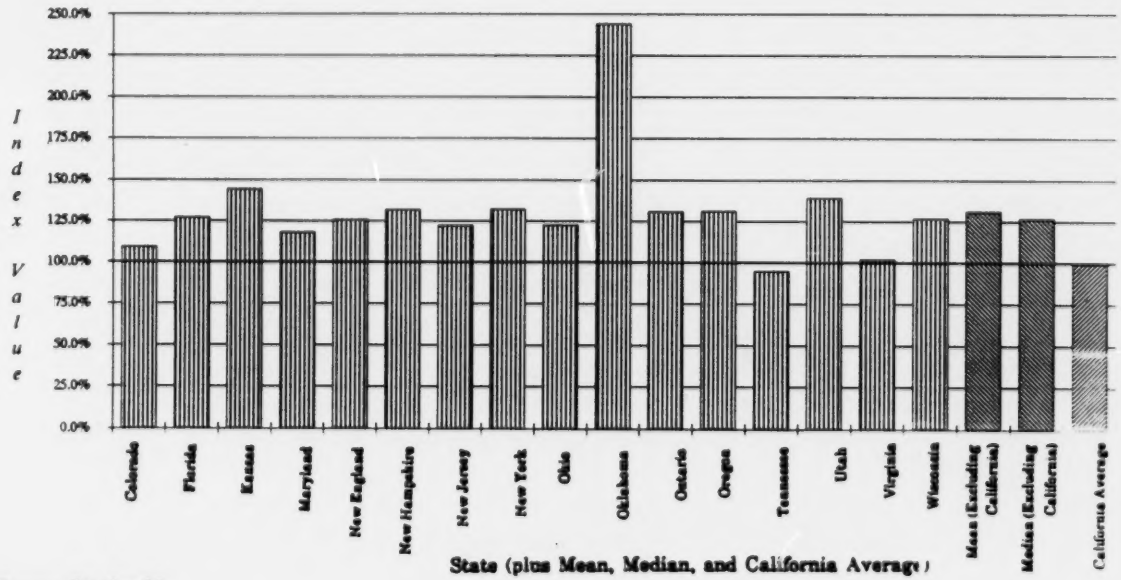
that the responsibilities assigned to each of the three public segments differ, and that these differences have implications for the establishment of appropriate office areas. This principle also appears to be at work in many other states, where office space allowances at research universities are invariably greater than for comprehensive institutions such as the State University, and where community college faculty office needs are consistently less than in four-year institutions. This parallel between Cali-

DISPLAY 86 *Assignable Square Feet of Academic Office Space Generated by the Surveyed State Formulas for the Prototype State University System*

State	Total ASF for All Positions	Percentage by Which Total ASF Exceeds California
Colorado	2,347,565	9.1%
Florida	2,735,715	27.1
Kansas	3,103,815	44.2
Maryland	2,545,340	18.2
Nebraska	2,709,395	25.9
New Hampshire	2,841,960	32.0
New Jersey	2,633,540	22.3
New York	2,843,040	32.1
Ohio	2,641,380	22.7
Oklahoma	5,257,438	144.2
Ontario	2,818,823	31.0
Oregon	2,821,650	31.1
Tennessee	2,036,809	-5.4
Utah	2,993,190	39.1
Virginia	2,196,450	2.0
Wisconsin	2,727,595	26.7
Mean (Excluding California)	**2,828,357**	**31.4%**
Median (Excluding California)	**2,727,593**	**26.7%**
California	**2,152,586**	**0.0%**

Source: MGT, 1989a.

DISPLAY 87 *Indexed Comparison of California State University Office Space Standards with Those in Other States*



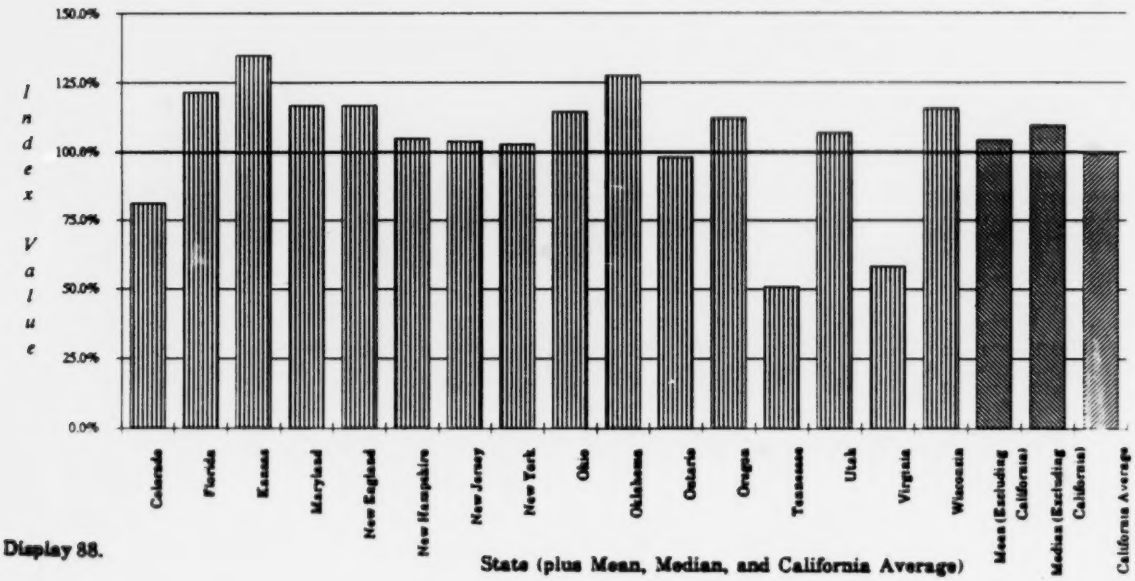
Source: Display 86.

DISPLAY 88 *Assignable Square Feet of Academic Office Space Generated by the Surveyed State Formulas for the Prototype Research University*

State	Total ASF for All Positions	Percentage by Which Total ASF Exceeds California
Colorado	1,996,250	-18.8%
Florida	2,985,550	21.5
Kansas	3,314,850	34.9
Maryland	2,871,050	16.8
Nebraska	2,872,750	16.9
New Jersey	2,574,600	4.8
New Hampshire	2,548,700	3.7
New York	2,524,800	2.7
Ohio	2,812,600	14.4
Oklahoma	3,135,027	27.6
Ontario	2,407,870	-2.0
Oregon	2,758,500	12.2
Tennessee	1,248,512	-49.2
Utah	2,626,500	6.9
Virginia	1,431,000	-41.8
Wisconsin	2,844,350	15.7
Mean (Excluding California)	**2,559,557**	**4.9%**
Median (Excluding California)	**2,692,500**	**9.6%**
California	**2,439,727**	**0.0%**

Source: MGT, 1989a.

DISPLAY 89 *Indexed Comparison of University of California Office Space Standards with Those in Other States*



Source: Display 88.

fornia and national practice lends greater credibility to the data contained in the national survey and suggests that California should be sensitive to national norms. Such awareness may be particularly important in the next ten years, when faculty recruiting will become a priority for all three segments. Just as California has a long-standing policy of setting faculty salary levels at approximately the average salary for comparison institutions in other states, it is also reasonable to ensure that the facilities provided for California's faculty are relatively consistent with national practice.

The following three sections detail the proposals for each segment, beginning with the California Community Colleges.

California Community Colleges

MGT's national survey showed that office standards for the California Community Colleges lag far behind national standards -- a fact that was repeatedly confirmed by the focus-group participants. The existing standard provides 140 assignable square feet per full-time-equivalent faculty member, which is intended to cover all academic office space plus all central administrative staff space, including district and campus-wide administrative facilities.

As shown in Displays 84 and 85, office space standards in the two-year segment rank last among the surveyed states, and do so at a time when the Legislature, through its Joint Committee for Review of the Master Plan, has attempted to encourage greater contact between faculty and students. At present, the faculty office allowance is so restrictive that it is virtually impossible to provide space for part-time faculty, even though these faculty constitute about two-thirds of the community colleges' headcount faculty, teach about one-third of their contact hours, and are commonly and increasingly required to hold office hours for their students. The State University's Trustees recently adopted a policy to provide for single faculty offices for full-time faculty. Such a policy in the community colleges, along with a provision for multiple-occupancy offices for part-time faculty, would doubtless be of assistance in meeting the Legislature's objective of improving their educational quality.

Another factor -- the increase in administrative responsibilities -- has caused the space available for faculty offices within the 140-assignable-square-feet standard to decrease over the past several decades. The original Coordinating Council recommendation of 140 assignable square feet for all academic and central administrative areas was "proposed as a reasonable standard for long-range planning for California public junior colleges," and included an additional 20 assignable square feet per instructional full-time-equivalent for smaller colleges (1966, p. 24). Both standards still exist in Title 5 of the California Administrative Code, but it is difficult to suppose that the Council could have foreseen the substantial growth in administrative responsibilities that the community colleges have since been asked to assume, including expanded financial aid, testing, and placement services; personal advising; affirmative action offices; disabled student counseling and advising; EOPS offices; and transfer centers. None of the space needs associated with these responsibilities has been recognized.

Over the past several years, there has been an increasing effort to move the community colleges away from their historic elementary and secondary education roots and toward the higher education community -- a move designed both to increase faculty professionalism and to improve educational quality generally. This professionalism is growing, and it suggests the adoption of a parallel policy to improve office facilities; to make them more like those to be found in the four-year segments than in the K-12 sector, where faculty office space is either very limited or does not exist at all.

For all of these reasons, a major increase in community college academic office space standards appears to be warranted, one that will permit a reasonable complement of furniture, space for personal computers or computer terminals, and a related amount of space for clerical services, conference rooms, and storage.

To determine the amount of that space, reference is made here to the *California Facilities Planning Guide for Higher Education*, developed in 1970 by the University of California in cooperation with the Coordinating Council. With regard to faculty offices, it contained a formula for determining the relationship between the space occupied by various items of furniture and equipment, and the total space required for the office. In general, that rela-

tionship, along with the authors' estimates for a normal complement of furniture, is shown in Display 90.

DISPLAY 90 Relationship Between the Area Occupied by Furnishings and Total Assignable Square Feet of Office Space

Area Occupied by Furnishings	Assignable Square Feet of Office Space
Less than 25 square feet	80 - 100 ASF
25 to 35 square feet	100 - 120 ASF
Over 35 square feet	120 - 140 ASF
Department Heads with 4-8 station conference table	160 - 180 ASF

Item of Furniture	Assignable Square Feet of Office Space
30 x 60 inch desk or table	12.5
File cabinet, desk chair, bookcase	3.0
Side chair	2.5
Wardrobe or storage cabinet	4.5
Total	22.5

Source: University of California and CCHE, 1970.

Such an arrangement would dictate an office of about 90 to 100 assignable square feet. At present, however, such an allocation no longer conforms to contemporary standards. While the desk size is doubtless appropriate, space should be provided for certain specific items. For example, it is curious that the storage items ("file cabinet . . . bookcase" and "wardrobe or storage cabinet") are separated and that only three assignable square feet are provided for "file cabinet, desk chair, bookcase" -- implying a functional mismatch between seating and storage. It seems more appropriate to ensure that a chair is provided for the desk, with another category to account for a reasonable complement of storage facilities such as bookcases, shelves, and filing cabinets. In addition, the allowance for chairs and cabinets seem restrictive, and few modern offices would neglect to allocate space for a personal computer. Display 91 suggests a possible configuration of furniture that produces a need for about 110 assignable square feet for the total office.

DISPLAY 91 A Suggested Normal Complement of Equipment for Community College Faculty Offices

Item of Furniture	Assignable Square Feet of Office Space
30 x 60 inch desk or table	12.5
Chair for the desk or table	3.5
File cabinet, bookcase or shelving	3.5
Side chair	2.5
Personal computer/terminal	8.0
Total	30.0

Source: Display 90 and Commission staff.

The next component of the office standard is space for support staff -- currently calculated by MGT at ten assignable square feet in the community colleges, or about 25 to 30 percent of the amount provided in the four-year segments. Although it is abundantly clear that the ten assignable square feet allocation is inadequate, there is no way to determine precisely what this allocation should be. There is a strong probability, however, that less space for this purpose is needed in the community colleges than in the other segments, since the responsibilities associated with upper-division and graduate instruction, plus research and publication, are absent. An allowance of 25 assignable square feet per full-time-equivalent faculty member is proposed as a reasonable standard.

The final item is service and storage -- currently not provided for the community colleges. In the four-year segments, this item is currently calculated at between 7 and 8 percent of the total of the first two categories (office plus support staff) -- an amount widely criticized in all of the focus groups as being inadequate. Accordingly, a 10 percent allowance is proposed for both the community colleges and the four-year segments.

By combining these three allowances (faculty offices, support staff, and service/storage areas), the resulting standard is 148.5 assignable square feet per full-time-equivalent faculty, which has been rounded to 150 assignable square feet per full-time-equivalent faculty. The community colleges would be expected to provide multiple occupancy office

space for part-time faculty out of the total space generated by this standard, as well as offices for full-time faculty and clerical, office service, and support space for academic programs. This standard is not intended to cover campus-wide and district administrative space needs, which should be determined in a subsequent study.

The California State University

The national survey showed that office space standards for the California State University lag 31.4 percent behind the standards used in other states for office space. While this is not as serious a deficiency as for the community colleges, it is still substantial. Display 92 on page 122 shows how the existing standards are applied in the State University system. The weighted average office allowance, including service and storage areas, is about 118.5 assignable square feet per full-time-equivalent faculty member. In addition, various State University allocation and design standards have been adopted by the Trustees and incorporated into the State University Administrative Manual (SUAM). These are shown in Display 93 on page 123. The allowance for support staff was calculated by MGT at 34.6 assignable square feet per full-time-equivalent faculty member. The resulting total of 153.1 assignable square feet per full-time-equivalent faculty member generated by the existing standards is intended to cover all academic offices, associated clerical and administrative support staff areas, conference rooms, and service/storage spaces.

At present, and as indicated in Display 93, there is no space standard for faculty conference or meeting rooms, which means alternatively that such rooms cannot be constructed at all, or if they are, must reduce the total amount of space provided for offices or support staff. Such "borrowing," where it occurs, tends to dilute the standards adopted originally in the *Restudy* (McConnell, 1955, p. 371). It should be noted as well that the provisions for multiple occupant faculty offices will probably be inapplicable in the future, since Section 9611.01 of the State University Administrative Manual specifies that "All new spaces constructed or spaces converted for faculty offices shall be individual offices (one station)."

As noted on pages 115 -117, California's principle of differentiation of function should be considered in the analysis of faculty office spaces. Increasingly, State University faculty are assuming research responsibilities that community college faculty do not have -- a factor that argues for additional space to house research materials, for writing, to confer with students and colleagues, and to process application and reporting forms associated with the acquisition of external grant funding.

State University faculty are also allotted more time for activities such as advising, curriculum development, committee work, and related public service endeavors -- all of which often require office and other administrative areas. For all of these reasons, the office allowance for State University faculty should be somewhat larger than in the community colleges, although less than at the University of California. A reasonable array of furniture for State University faculty, including a personal computer, is shown in Display 94 on page 123, with the allowance for a faculty office consequently increasing from the current 110 assignable square feet per full-time-equivalent faculty member to 125 assignable square feet.

Although the current allotment for support staff office space was considered by the faculty participants in the focus groups to be insufficient, it is nevertheless proposed here that that figure remain virtually unchanged at 35 assignable square feet per full-time-equivalent faculty member. With the more generous overall standard, and the flexibility built into it, it is assumed that all support staff will be adequately accommodated.

The combination of these three allowances produces a figure of 176 assignable square feet, which has been rounded to 175. With the flexibility built into this standard, it should permit individual campuses to meet their needs. It would be expected to provide space for faculty up through department chairs, all related academic clerical and conference room areas, plus service and storage areas.

University of California

According to MGT, the University of California's office space allocation system is the most complex in

DISPLAY 92 California State University Faculty Office Space Allowances

Discipline	Proportion of Students	ASF/ Faculty	ASF/ Faculty FTE for Administration	Added Percent of Faculty + Administration for Support
Agriculture	1.2%	110.0	40	10.0%
Anthropology	1.2%	110.0	30	7.5%
Architecture	0.6%	110.0	40	15.0%
Area Studies	0.6%	110.0	25	5.0%
Art	2.4%	110.0	25	10.0%
Biological Sciences	3.9%	110.0	35	10.0%
Broadcast Communication Arts	0.5%	110.0	25	10.0%
Business Admin. & Economics	17.5%	110.0	33	7.0%
Communications	1.7%	110.0	25	5.0%
Computer Science	2.6%	110.0	30	5.0%
Education	6.4%	110.0	50	10.0%
Engineering	5.4%	110.0	40	15.0%
Fine Arts	4.3%	110.0	25	10.0%
Foreign Languages	2.6%	110.0	25	5.0%
Geography	1.4%	110.0	30	7.5%
Health Professions	3.7%	110.0	50	10.0%
Health Science	0.1%	110.0	50	10.0%
Home Economics	1.5%	110.0	50	10.0%
Humanities, General	10.7%	110.0	25	5.0%
Industrial Arts	1.0%	110.0	30	15.0%
Journalism	0.6%	110.0	50	10.0%
Mathematics	5.5%	110.0	25	5.0%
Physical Sciences	5.4%	110.0	35	10.0%
Psychology	4.1%	110.0	30	7.5%
Public Administration	2.4%	110.0	25	5.0%
Social Sciences, General	12.7%	110.0	25	5.0%
Weighted Average/Total	**100.0%**	**118.5[1]**	**34.6[2]**	**7.7%[2]**

1. The 110 ASF per faculty office has been augmented by the percentage allowance for support and service areas, then weighted by the proportion of students.
2. Weighted by the proportion of students.

Source: MGT, 1989a

DISPLAY 93 California State University Design Criteria for Faculty Offices and Related Space

Position and/or Number of Occupants	Assignable Square Feet
Professional staff, one occupant	110
Professional staff, two occupants	160
Professional staff, three occupants	240
Professional staff, more than three occupants in the same office	240+80 for each additional occupant
Secretary or typist	160
Clerical or technical support staff, two occupants	160
Clerical or technical support staff, three occupants	230
Clerical or technical support staff, four occupants	300
Student assistant	60

Filing Equipment in Office	Assignable Square Feet
File, including work space	10
File, not including work space	6

Source: California State University, 1986b, Section 9611.

DISPLAY 94 A Suggested Normal Complement of Equipment for California State University Faculty Offices

Item of Furniture	Assignable Square Feet of Office Space
30 x 60 inch desk or table	12.5
Chair for the desk or table	3.5
File cabinets and/or bookcases	12.0
Side chair	2.5
Personal computer/terminal	10.0
Subtotal	40.5

Source: Commission Staff.

the nation, since, unlike the other segments and the rest of the nation, its standards for academic offices vary by discipline category. The University's system is shown in Display 95 on page 124, which indicates that, based on a weighted average of the existing distribution of enrollments by discipline, the standards provide an average of 138.7 assignable square feet per full-time-equivalent faculty member, with an additional 39.5 assignable square feet for clerical and other support staff. Service and storage areas were computed by MGT at 7.1 percent of the basic total for faculty and support staff, and are included in the above figures. The existing standards provide for the same allowance for full-time-equivalent teaching assistants. The specific standards range between 120 and 160 assignable square feet for faculty offices, 30 to 80 assignable square feet per full-time-equivalent faculty member for administrative support, and between 5 and 15 percent of the first two numbers for service and storage areas. The same numbers apply to teaching assistants, except that their part-time status normally requires multiple occupancy.

At present, the space generated by these allowances must cover all academic office areas, including faculty, teaching assistants, postdoctoral fellows, and visiting and emeriti faculty, as well as all administrative and clerical support staff, conference rooms, and service/storage areas in instruction and research departments.

The University's office space standards also include an average allowance of 25.2 assignable square feet per headcount graduate student, based on average three quarter/two semester enrollments, with the specific standards ranging from five to 30 assignable square feet per graduate student, depending on the discipline involved. This standard derives from a *Restudy* recommendation for "new square feet per FTE graduate student for instruction and research," and since all graduate students at the University are counted as full-time-equivalents, headcount and

DISPLAY 95 University of California Space Allowances

Discipline	Proportion of Students	ASF/ Faculty	ASF/ Headcount Grad. Stud.	ASF/Fac. FTE for Admin.	Added Percent of Faculty + Administration for Service/Storage
Administration	0.9%	140.0	10.0	47	6.7%
Agric. Biol. Sciences	0.3%	130.0	15.0	55	10.0%
Agric. Economics	0.1%	140.0	30.0	47	6.7%
Agric. Science	0.6%	140.0	15.0	60	10.0%
Anthropology	2.5%	125.0	15.0	40	7.5%
Architecture (Env. Dsgn.)	0.3%	140.0	10.0	30	10.0%
Arts, Performing	4.4%	140.0	15.0	30	10.0%
Arts, Visual	3.0%	140.0	15.0	30	10.0%
Biological Sciences	6.2%	120.0	15.0	50	10.0%
Computer Science	0.7%	145.0	15.0	45	10.0%
Education	0.2%	160.0	10.0	80	10.0%
Engineering Sciences	2.9%	160.0	15.0	60	15.0%
Engineering, Agric.	0.0%	160.0	15.0	60	15.0%
Engineering, Chemical	0.0%	140.0	15.0	55	12.5%
Foreign Languages	7.8%	130.0	30.0	30	5.0%
Geography	1.1%	125.0	35.0	40	7.5%
International Relations	0.0%	160.0	10.0	80	10.0%
Journalism	0.0%	160.0	30.0	80	10.0%
Law	0.0%	160.0	5.0	80	10.0%
Letters	19.9%	130.0	30.0	30	5.0%
Library Science	0.1%	160.0	10.0	80	10.0%
Mathematical Science	13.0%	130.0	30.0	30	5.0%
Physical Sciences	14.8%	120.0	15.0	50	10.0%
Psychology	4.0%	125.0	15.0	40	7.5%
Social Ecology	0.4%	125.0	15.0	40	7.5%
Social Sciences, General	15.6%	130.0	30.0	30	5.0%
Social Welfare	0.0%	130.0	10.0	30	5.0%
Speech	0.0%	135.0	22.5	30	7.5%
Studies, Applied Behav.	0.3%	140.0	15.0	80	10.0%
Studies, Creative	0.0%	130.0	30.0	30	5.0%
Studies, Environmental	0.1%	125.0	35.0	40	7.5%
Studies, Interdisciplinary	0.8%	130.0	30.0	30	5.0%
Weighted Average/Total	100.0%	138.6[1]	25.2[2]	39.5[2]	7.1%[2]

1. The faculty office allocations have been augmented by the percentage allowance for support and service areas, then weighted by the proportion of students.

2. Weighted by the proportion of students.

Source: MGT Consultants, 1989b, Exhibit A.

full-time-equivalent enrollment are the same. Display 96 shows how the *Restudy* team arrayed the standards for graduate students in 1955.

DISPLAY 96 Office and Research Space Standards for Graduate Students at the University of California

Discipline	ASF per Graduate Student for Instruction and Research
Agriculture	200
Arts	140
Engineering	200
Languages and Literature	30
Mathematics	40
Other Professions	60
Physical Education	160
Biological Sciences	160
Physical Sciences	160
Social Sciences	30

Source: McConnell, 1955, p. 312.

Over the next several decades following publication of the *Restudy*, the complexity of the curriculum increased dramatically as other disciplines or subdisciplines were added, and the original graduate student standards evolved into a bifurcation between offices and research space. Display 98 on page 126 shows the current standards, with the original standards shown in bold type.

From that display, it can be seen that the standards have become increasingly detailed, as evidenced by the functional split in graduate student space. Such detail may be necessary as a campus planning tool, but its utility as a State-level budget standard is doubtful. Graduate students in various disciplines may or may not require office space, but since virtually all such students are involved in research activities, they undoubtedly do require research space in which to do their work. Following one of the major objectives of the space standards project -- to create simpler and more easily administrable standards -- it seems prudent to assign the graduate student standard to the area of greatest activity or emphasis, and that area is clearly research. Accordingly, it is proposed that the office allowance for graduate students be incorporated into the research laboratory standard, with the stipulation that the space allowance generated by the standard cover whatever graduate student office space may be required in conjunction with research activities.

Concerning the office standard itself, it was noted above that research university faculty need more office space than faculty at comprehensive state universities or community colleges. The University's research function is the primary reason for this difference, because it necessitates greater interaction between faculty, graduate students, and other research staff, the collection of research materials, and an increased number of administrative and business personnel related to the acquisition and monitoring of research funding.

It is proposed that the University's standard be raised to 195 assignable square feet per full-time-equivalent faculty member, and that it be applied to total full-time-equivalent faculty, full-time-equivalent teaching assistants, and full-time-equivalent postdoctoral fellows. (The specific rationale for adding postdoctoral fellows to the standard was discussed in Part Six.) The composite standard of 195 assignable square feet is comprised of the following three allowances: approximately 140 assignable square feet for the academic office, based on the furniture "footprint" shown below; 40 assignable square feet for administrative and support staff space; and 18 assignable square feet (10 percent) for service and support. The total is 198.0, which has been rounded down to 195.

The detailed calculations for all three segments are shown in Display 99 on page 127.

DISPLAY 97 A Suggested Normal Complement of Equipment for University of California Faculty Offices

Item of Furniture	Assignable Square Feet of Office Space
30 x 60 inch desk or table	12.5
Chair for the desk or table	3.5
File cabinets and/or bookcases	24.0
Side chair	2.5
Personal computer/terminal	10.0
Subtotal	52.5

Source: Commission Staff.

DISPLAY 98 *University of California Planning Guidelines Graduate Student Office and Research Space, by Academic Program, May 1986*

Discipline	Offices	Research Labs	Total
Biological Sciences	**15**	**145**	**160**
Agricultural Sciences			
Agricultural Sciences	**15**	**185**	**200**
Agricultural Economics	30	0	30
Agricultural Biological Sciences	15	165	180
Mathematical Sciences	30	0	30
Computer Science	15	100	115
Physical Sciences	**15**	**145**	**160**
Engineering & Chemical Engineering			
Engineering Sciences	**15**	**185**	**200**
Chemical Engineering	15	165	180
Agricultural Engineering	15	285	300
Psychology	15	80	95
Social Sciences			
General Social Sciences	**30**	**0**	**30**
Anthropology	15	80	95
Geography	35	60	95
Arts			
Visual Arts	**15**	**125**	**140**
Performing Arts	**15**	**125**	**140**
Letters			
Letters	**30**	**0**	**30**
Speech	22.5	62.5	85
Foreign Languages	**30**	**0**	**30**
Interdisciplinary Studies			
Interdisciplinary Studies	30	0	30
Applied Behavioral Studies	15	35	50
Environmental Studies[1]	15	143	158
Environmental Studies[2]	35	60	95
Social Ecology	15	80	95
Creative Studies	30	0	30
International Relations	10	20	30
Administration	10	20	30
Education	10	20	30
Environmental Design & Planning	10	130	140
Law	5	25	30
Social Welfare	10	20	30
Journalism	30	0	30
Library Science	10	20	30

1. Davis Campus
2. Santa Barbara and Santa Cruz campuses

Source: University of California, Office of the President

DISPLAY 99 Effect of Changes in Academic Office Standards (Based on Data Contained in the MGT National Survey)

Item	Number of Positions	ASF Generated	Mean ASF per National Survey	National Mean Exceeds Calif. by:
California Community Colleges				
EXISTING STANDARDS:				
Faculty Offices – 85 ASF per FTE Faculty	28,713	2,727,735	4,290,132	57.3%
Support Staff Offices – 10 ASF per FTE Faculty	2,871	—	—	—
Service/Storage – None	—	—	—	—
PROPOSED STANDARDS[1]:				
Faculty Offices – 150 ASF per FTE Faculty	28,713	4,306,950	4,290,132	-0.4%
Support Staff Offices – Included under Faculty	2,871	—	—	—
Service/Storage – (Included above)	—	—	—	—
California State University				
EXISTING STANDARDS:				
Faculty Offices – 118.5 ASF per FTE Faculty	14,060	2,152,586	2,828,357	31.4%
Support Staff Offices – 34.6 ASF per FTE Faculty	2,850	—	—	—
Service Storage – 7.7 percent of Faculty plus Support (included above)	—	—	—	—
PROPOSED STANDARDS[2]:				
Faculty Offices – 175 ASF per FTE Faculty	14,060	2,460,500	2,828,357	15.0%
Support Staff Offices – Included under Faculty	2,850	—	—	—
Service/Storage – (Included above)	—	—	—	—
University of California				
EXISTING STANDARDS:				
Faculty Offices – 138.7 ASF per FTE Faculty	7,600	1,354,320	—	—
Support Staff Offices – 39.5 ASF per FTE Faculty	6,600	—	—	—
Teaching Assistant Offices – 138.7 ASF per FTE TA	2,460	438,372	—	—
Support Staff Offices – 39.5 ASF per FTE TA	6,600	—	—	—
Graduate Student Offices – 25.2 ASF per Headcount	25,676	647,035	—	—
Service Storage – 7.1 percent of Faculty plus Support (included above)	—	—	—	—
Total	—	2,439,727	2,559,557	4.9%
PROPOSED STANDARDS[3]:				
Faculty Offices – 195 ASF per FTE Faculty	7,600	1,482,000	—	—
Support Staff Offices – Included under Faculty	6,600	—	—	—
Teaching Assistant Offices – 195 ASF per FTE TA	2,460	479,700	—	—
Postdoctoral Offices – 195 ASF per FTE Postdoctoral	1,700	331,500	—	—
Support Staff Offices – Included under TA's and Postdoctorals (Includes Research Assistants, Graduate Assistants, Technicians, and Clerical)	2,850	—	—	—
Graduate Student Offices – None (Included under Research Laboratories)	—	—	—	—
Service Storage – (Included above)	—	—	—	—
Total	—	2,293,200	2,559,557	11.6%

1. The proposed California Community College standard is based on a faculty office of 110 assignable square feet (ASF), plus 25 ASF for support staff, plus 10 percent for service/storage areas. The resulting calculation produces 148.5 ASF, which has been rounded to 150.

2. The proposed California State University standard is based on a faculty office of 125 ASF, plus 35 ASF for support staff, plus 10 percent for service/storage areas. The resulting calculation produces 176 ASF, which has been rounded to 175.

3. The proposed University of California standard is based on a faculty office of 140 ASF, plus 40 ASF for support staff, plus 10 percent for service/storage areas. The resulting calculation produces 198 ASF, which has been rounded to 195. The same calculations are used for teaching assistants and postdoctorals.

Source: MGT, 1989a; and Commission Staff

Appendix A *Time and Territory: Phase II*

Note: The following material reproduces the text of *Time and Territory: Phase II, A Report to the Legislature in Response to Supplemental Language in the 1985-86 Budget Act*, which the Commission published as Report 86-12 in April 1986.

Background

During the 1985 legislative session, a controversy arose concerning the University of California's capital outlay request. It centered on the question of appropriate space and utilization standards, since the University was requesting facilities the size of which exceeded the allowances provided by both legislation and tradition. In order to answer questions posed by the Legislative Analyst, the University argued that the standards -- particularly the square footage allotments for research laboratories that were developed in the mid-1950s -- were seriously outdated, and that the University could not build state-of-the-art laboratories unless it was granted the requested space. Additional debate focused on the utilization standards that require classrooms and teaching laboratories to be used for a predetermined number of hours each week.

During the budget hearings, the University's arguments tended to prevail, as funding for most of the requested facilities was approved by the Legislature and the Governor. However, to prevent a recurrence of the arguments that characterized the 1985 hearings, the Legislature approved Supplemental Language to the 1985-86 Budget Act that was designed to provide new data and information on the subject of space and utilization standards. That language called for a major study to be conducted in two phases, the first a preliminary exploration of selected disciplines, and the second a comprehensive analysis of the entire subject as it applied to all disciplines. It provided as follows:

> The California Postsecondary Education Commission (CPEC) shall study the current space and utilization standards for undergraduate class and graduate laboratories and faculty research/office space in public higher education. By December 1, 1985, the CPEC shall report its recommendations for changes, if found necessary, to the existing space and utilization standards for the disciplines of engineering, biological sciences, and physical sciences to the Chairs of the legislative fiscal committees and the Joint Legislative Budget Committee (JLBC). The CPEC shall provide a report on the status of its review and plan to complete the study for all remaining disciplines, to the same committees by April 1, 1986. It is legislative intent that any revisions in the current space and utilization standards will be incorporated into the capital outlay programs for the 1986-87 budget (Item 64320-001-001, Number 4).

Pursuant to that language, on February 3, 1986, the Commission approved a report entitled *Time and Territory: A Preliminary Exploration of Space and Utilization Guidelines in Engineering and the Natural Sciences*. In that report, the Commission recommended several changes in the current utilization standards for classrooms and teaching laboratories, and a substantial increase in the square footages allowed for University of California research laboratories. It also recommended that, subject to a case-by-case approval process by State officials, the California State University be permitted 75 percent of the University of California's research laboratory allotment. The new guidelines were proposed only for an interim period -- the 1986-88 biennium -- to permit sufficient time for a more comprehensive analysis of the subject.

In this report, the Commission responds to the second part of the Supplemental Language to "report on the status of its review," and to provide a "plan to complete the study for all remaining disciplines" by April 1, 1986.

Current status of the Commission's review

To complete the first phase of this project, the Commission utilized a Technical Advisory Committee that included representatives from the Department of Finance, the Office of the Legislative Analyst, the University of California, the California State University, and the California Community Colleges. This committee met on three occasions, and individual members supplied Commission staff with substantial amounts of data and information on the subject of facilities utilization. At its final meeting on February 14, 1986, the committee reviewed the *Time and Territory* report briefly, but most of its time was spent discussing the requirements of the second phase. Those requirements were presented in outline form, and from the discussion, it emerged that whereas much of the Commission's initial work was confined to the accumulation and analysis of data, a substantial amount of the remaining effort will require the exercise of judgment to resolve such questions as which disciplines require guidelines, how large faculty offices should be, and how consistent inventories should be among the segments. This is not to say that sufficient data for this study has already been obtained, for it was agreed by all concerned that a substantial amount remains to be collected, but it seems clear that a major effort will have to be directed to resolving many of the definitional and judgmental questions discussed below in the next section of this report.

Accordingly, the Commission's first action for Phase II will be to establish a Policy Advisory Committee. It will contain the same representation as the technical committee, but will be asked not only to supply data and answer analytical questions, but also to offer guidance on the proper course of the study, and to approve whatever final recommendations emerge. It is expected that the membership of this committee will be finalized within two months. At its first meeting, the committee will be asked to approve a final study outline and a time schedule for completing various required tasks.

The Commission's plan for the Phase II study

The plan for the Phase II study contains five elements:

1. Data requirements and personnel definitions
2. Academic program issues,
3. Detailed survey of other states and institutions,
4. Division of labor, and
5. Time schedule.

These elements are detailed in Display 1 on the opposite page and described in the following paragraphs.

1. Data requirements and personnel definitions

In studies of space and utilization guidelines, the first essential element is a comprehensive facilities inventory. Without such an inventory, it is impossible to determine which spaces are being used for which purposes; how often they are used by students, faculty, and others; and how much space is not amenable to the application of guidelines. Further, unless there is a degree of compatibility among the inventories in each of the segments, it is impossible to avoid the complexity of applying different guidelines to rooms that appear functionally similar but in fact are not.

In Phase II, a major effort will be directed to an intersegmental analysis of existing inventories to determine their comprehensiveness and consistency. At present, the University of California defines nonhospital space in 14 broad categories and 89 subcategories, each having its own definition. If hospital facilities are included, the total rises to 124. The California State University uses about 45 different space classifications, many of which are then cross referenced by academic discipline. The classification systems employed by various Community College districts have not yet been determined.

Nationally, many institutions are now using the Classification of Instructional Programs (CIP) taxonomy developed in 1981 by the National Center for Education Statistics (NCES). This system arranges

DISPLAY 1 Suggested Outline for Phase II of the Study of Space Utilization Guidelines in California Public Higher Education

1. Data requirements and personnel definitions

- 1.1. Facilities inventories
  - 1.11 Intersegmental compatibility
  - 1.12 Need for intersegmental consistency
  - 1.13 Update of space codes
  - 1.14 Types of spaces to be included and excluded
- 1.2. Utilization studies
  - 1.21 Data categories
  - 1.22 Need for intersegmental consistency
- 1.3. The student basis for space and utilization guidelines
  - 1.31 Credit versus non credit
  - 1.32 Student credit hours versus weekly student contact hours
  - 1.33 Full-time-equivalent versus headcount enrollment
  - 1.34 Determination of levels (lower division, upper division, G-1, G-2, etc)
- 1.4. The non-student basis for space and utilization guidelines
  - 1.41 Full-time-equivalent versus headcount faculty
  - 1.42 Budgeted versus actual faculty positions
  - 1.43 Other personnel (teaching assistants, research technicians, postdoctoral fellows, full-time research staff, etc.)

2. Academic program issues

- 2.1 Taxonomy of programs for which guidelines should be established
- 2.2 Survey of curricular requirements
  - 2.21 Course content changes since 1955 and 1966
    - 2.211 Classrooms
    - 2.212 Teaching laboratories
    - 2.213 Research laboratories
  - 2.22 Changes in contact hours (lecture versus laboratory)
  - 2.23 Needs for support space (all lecture rooms and laboratories)

3. Detailed survey of other states and institutions

- 3.1 Comparability of facilities inventories
- 3.2 Comparability of utilization studies
- 3.3 Comparability of space standards and guidelines
- 3.4 Inclusion of both public and independent institutions?
- 3.5 Emphasis on University and State University comparison institutions?
- 3.6 Examination of useful innovations, such as differential guidelines by size of lecture facility and categorization of laboratories by function rather than by discipline

4. Organization

- 4.1 Establishment of Policy Advisory Committee
- 4.2 Organization of policy committee study agenda
- 4.3 Establishment of technical subcommittees
- 4.4 Consultation processes (faculty, administrators, students, board members, others)
- 4.5 Retention of one or more consultants
- 4.6 Need for special appropriations

5. Time schedule

- 5.1 Establishment of policy committee, technical subcommittees, and retention of consultants
- 5.2 Development of inventories, utilization studies, taxonomies, and out-of-state surveys
- 5.3 Deadlines for consultants' reports
- 5.4 Frequency of progress reports
- 5.5 Date of final report

disciplines according to two-, four-, and six-digit levels of aggregation. For example, the field of inorganic chemistry is assigned a code of "40.0503." The "40" refers to the physical sciences in general, the "40.05" to chemistry, and the "40.0503" to inorganic chemistry in particular. Throughout the entire taxonomy, there are 50 disciplines identified at the two-digit level, 369 at the four-digit level, and about one thousand at the six-digit level. Unfortunately, the University uses a slightly different classification system and the State University uses the now outdated HEGIS Taxonomy, which the NCES formulated in 1970.

A primary challenge to the Phase II study will be to determine how congruent the facilities inventories need to be, and then to decide which types of facilities are amenable to the applications of guidelines and which are not. A substantial amount of time will also be devoted to analyzing space use, as there is already some evidence that facilities usages do not conform to their intended purpose or inventory classification. It must also be determined which types of spaces -- for example teaching laboratories -- need to be delineated further by discipline.

The second step will be to obtain comprehensive utilization studies for all three segments. The State University already publishes such a study annually, but it remains to be decided if its data categories are appropriate or need to be revised. University of California campuses also do some utilization analyses, but it is not yet known if they are done consistently throughout the system or if they are organized in such a way as to be useful to the current project. At present, little is known about the utilization of Community College facilities.

There are a number of major policy questions in this category of the study as well.

- Will future guidelines include both credit and non-credit students?
- Should the guidelines be based on student credit hours or weekly student contact hours?
- Can the guidelines be based on full-time-equivalent (FTE) students, as in New York, or on headcount students as for some categories of space at the University of California?
- At how many levels should the guidelines be applied -- just lower and upper division as at present, or also at the graduate level, or several stages of the graduate level, as in master's degree students, Ph.D. students, and postdoctorals?
- In allocating space for faculty offices and laboratories, should space be generated on the basis of full-time equivalent or headcount faculty, or by budgeted or actual numbers of faculty members?
- Finally, should space be allowed for ancillary staff such as teaching assistants and research technicians?

2. Academic program issues

In most cases, academic program questions are not applicable to classrooms, since lecture spaces are almost always assigned to a general category and used by all academic departments. In the first part of the space study, however, it emerged that some states apply different guidelines for assignable square feet per station to different sizes of lecture facilities, allowing more space in small classrooms and seminar rooms and less space in large lecture halls. The possibility of applying a similar system in California will be fully explored in Phase II

The dominant question in this section of the study will relate to which disciplines require specific guidelines, and then to what those guidelines should be. The focus here will probably be on teaching and research laboratories and not on classrooms, since classrooms are used for essentially the same purposes by all disciplines, but it will also consider faculty offices and related support spaces. In 1966, when the Coordinating Council for Higher Education published the last comprehensive study of the subject, it recommended space-per-station guidelines for 14 academic disciplines and 24 vocational specialties. Since that time, there has been considerable change in academe, enough to encourage the National Center for Education Statistics to develop the Classification of Instructional Programs system mentioned earlier, which not only reflects recent changes in existing disciplines but also included new fields of knowledge that did not exist as formal disciplines when the HEGIS system was formulated in 1970. Examples include computer engineering, family economics, parasitology, peace studies, psychopharmacology, public sanitation, and soil physics, to name just a few. At present, little detailed information exists on how these changes have affected space standards, but preliminary information collected for the *Time and Territory* re-

port suggested that space needs have increased dramatically in some areas through the introduction of new equipment and the addition of personnel to research teams, while in other fields, advances in miniaturization have largely neutralized equipment additions. Further, the acceptance of computers as basic tools in virtually all academic endeavors may well have increased space needs, particularly in faculty offices.

A final concern in this category relates to changes in the relationship between contact hours and credit hours. In some disciplines, far more laboratory time is required relative to lecture time for the same number of credit units earned. This phenomenon will have to be examined and analyzed in terms of its impact on facilities needs.

3. Detailed survey of other states and institutions

One of the caveats that preceded the recommendations in *Time and Territory* noted that:

> this report places considerable reliance on national data. In doing so, however, the Commission recognizes that the data from some states are unconfirmed, while that from others are too general to be directly applicable to California. Those data that are both available and reliable strongly suggest that California's standards may be too restrictive, but that conclusion must be subject to further investigation.
>
> . . . the mere fact that California's standards are substantially different from those found in other states does not, in itself, require California to change. California's system of higher education is unique in many respects, and doubtless will remain so (p. 64).

All space and utilization studies strive for data consistency in order to assure that valid comparisons can be made. For example, a utilization survey conducted in another state may include extension students where California does not, or it may count students in different ways than dictated by established practices here. Further, facilities inventories may have similar sounding classifications but different definitions, and it is usually not possible to distinguish the differences from published reports. Finally, many applications of space and utilization guidelines are informal and not contained in any publication, a circumstance that appears to obtain relative to community colleges in particular

To avoid data inconsistencies, there is no alternative to actual site visits to campuses and planning agencies in other states and spending time talking to facilities planners. Only in that way can the mechanics of space allocation be determined, for much of the process of reaching understandings involves a comparison of inventories, utilization studies, and space formulas contained in written documents, not all of them published or even obtainable by other than extensive contact with the people who use them on a daily basis. Some of that can be accomplished on the telephone, but the process is greatly aided by personal contacts.

Current plans call for visits to as many as 25 states for an average of three days per state. The individuals making those visits will be expected to conduct structured interviews with facilities planners, to examine all relevant documentation, to determine how closely other states can be compared to California, and to suggest useful innovations. It is not intended that this process imply that California should conform to the practices of others, but that the State be informed of practices elsewhere. It is likely that some ideas should be transplanted and others rejected, but it is probably naive, and certainly imprudent, to think that a survey as comprehensive as that required by the Supplemental Language can be performed without examining national practices and experiences.

4. Division of labor

Phase II of this study will be directed by the Commission in cooperation with the Policy Advisory Committee noted earlier. That committee will have an agenda similar to the outline shown in Display 1 on page 3, and it will employ a number of technical subcommittees with responsibilities for acquiring information on the subjects discussed above. Much of the work will be performed by the segments, such as the development of inventories, the presentation of utilization studies, and the development of lists of disciplines and categories of space (taxonomies) to which guidelines should be applied. Current plans also call for the retention of three consultants or consulting firms -- one to conduct the survey of other states and institutions, another to analyze the facilities inventories and utilization studies of the California segments for accuracy and consistency, and a third to undertake a comprehensive analysis

DISPLAY 2 Cost Estimate for Consultants to Complete Phase II of the Space and Utilization Guidelines Study

Item	Cost
Part One: Survey of Space and Utilization Guidelines in Other States	
1. Transportation costs to visit 25 states Three days per visit; two weeks for each group of three states; eight trips $1,200 per diem plus $1,200 travel per trip	$20,000
2. Consultant fees for state visits, data analysis, and report preparation $8,400 at $400 per day, 21 days per month for ten months	84,000
3. Data processing, publication costs, incidentals	30,000
Total Part One Costs	$134,000
Part Two: Facilities Inventory and Utilization Study Analysis	
1. Transportation costs to visit 25 California campuses Three days per visit $225 per diem plus $150 travel per visit	$9,375
2. Analyze segmental data and consult with Policy Committee and CPEC $8,400 at $400 per day, 21 days per month for four months	33,600
3. Data processing, publication costs, incidentals	30,000
Total Part Two Costs	$72,975
Part Three: Changes in Curricular Content and Practice	
1. Visit campuses and segmental offices 40 visits $75 per diem plus $150 travel per visit	$9,000
2. Analyze segmental data and consult with Policy Committee and CPEC $8,400 at $400 per day, 21 days per month for six months	50,400
3. Data processing, publication costs, incidentals	30,000
Total Part Three Costs	$89,400
Total Costs	$296,375

of the changes in curricular content and practice over the past 30 years and how those changes have affected facilities needs as well as analyze the disciplinary taxonomies developed by the segments and recommend a list of disciplines to which guidelines should be applied. The Commission will coordinate all activities of the policy committee, the technical subcommittees, and the consultants, and ultimately publish a final report with specific recommendations.

A special appropriation will be required to complete the requirements of the Supplemental Language. As noted in *Time and Territory*, the last effort of this magnitude (the 1955 *Restudy*) required two years to complete and involved 43 people -- not all of them involved in the facilities study. The current effort will require a similar length of time and will probably involve as many individuals, most of them from the segments themselves. Therefore, the costs listed in Display 2 are only for the three consultants necessary to survey other states and coordinate the activities of segmental staffs.

5. Time schedule

The approximate time schedule for Phase II is as follows:

April, 1986. Establishment of Policy Advisory Committee.

April-December, 1986: Development of facilities inventories.

April-March 1987: Development of utilization studies.

December 1985 - December 1986: Development of disciplinary taxonomy.

May-June, 1986: Establishment of technical advisory committees.

May 1986: Meeting of Policy Advisory Committee and retention of consultant for out-of-state survey.

September 1986: Meeting of Policy Advisory Committee.

September 1986-June 1987: Survey of other states.

October 1986: Progress report to the Commission.

December 1986: Meeting of Policy Advisory Committee and retention of consultant to analyze changes in curricular content and practice.

January 1987: Retention of consultant to analyze facilities inventories and utilization studies.

March 1987: Meeting of Policy Advisory Committee.

April 1987: Progress report to the Commission.

July 1987: Submission of consultants' reports on (1) the out-of-state survey, (2) curricular content and practice, and (3) facilities inventories and utilization.

June 1987: Meeting of Policy Advisory Committee.

July-September, 1987: Submission of reports by technical committees.

September 1987: Meeting of Policy Advisory Committee.

September-December, 1987: Development of final report draft.

October 1987: Progress report to the Policy Development Committee of the Commission.

December 1987: Meeting of Policy Advisory Committee.

January 1988: Revision of final report draft.

February 1988: Meeting of Policy Advisory Committee.

March-April, 1988: Submission of final report to the Policy Development Committee and Commission.

Conclusion

As noted in *Time and Territory*, a comprehensive analysis of utilization standards has not been conducted in California for 20 years, and a similar study of research laboratory space standards has not been undertaken for 31 years. Given the changes that have occurred in teaching methods and in both the techniques and technology of research since then, it seems virtually certain that the existing standards are obsolete in some degree. The recommendations in *Time and Territory* spoke to this problem and offered interim guidelines to be used for the next two years, but those recommendations were presented in the only form the limited time frame allowed -- as estimates or approximations. In the long run, such generalizations will not inspire confidence among policy makers, who must have a clear idea not only that State funds are being appropriated for valid purposes, but also that they are allocated in the correct amounts.

It was noted repeatedly in the course of the preliminary examination that the subject of space and utilization standards is enormously complex and that many people will have to be involved over a considerable period of time before definitive and credible guidelines can be developed. Studies of this type must necessarily attend to the entire scope of the educational enterprise, for the size, configuration, and utilization of campus spaces have much to do with both the number of students that can be educated and the quality of the experience they receive. It also has a profound influence on the viability of the research process.

There is little doubt that the process by which buildings are built on campuses has been regarded as somewhat mysterious. Claims are made by educators that certain kinds and sizes of spaces are essential, and these are often countered by State-level analysts who argue that the same can be done with

less space, and therefore, less money. Arguments often become permeated with the common parlance of the field, terms like "space factors," "preliminary plan packages," "space summary analyses," "assignable square feet per weekly student contact hour," "CIP codes," and similar jargon. Beyond that, other arguments will revolve around differences of opinion that can never be resolved in hearing rooms, such as how many square feet a molecular biologist needs to conduct his research, the ideal size of a seminar room, and the number of hours a lecture hall should be used each week.

Yet in spite of this inevitable confusion, the Governor and the Legislature must have confidence in their appropriation decisions, just as the segments of California higher education deserve confidence that their legitimate facilities needs can be met. Such confidence can only be created through a process that generates comprehensive data and produces a consensus of opinion. At present, a consensus exists on only one point -- that the existing space and utilization standards are obsolete and in need of revision. That is clearly indicated by both the passage of the Supplemental Language mandating this study, and by the continually voiced complaints of the segments that some of the standards are inadequate.

In recent years, dissatisfaction with the current state of affairs in capital outlay planning has not been overly serious due to the fact that very little construction money has been available, but with literally hundreds of millions of dollars in requests waiting to be considered, and with a probable new boom in enrollments coming in the early 1990s, the need for a major reexamination of the subject now is critical. If that study is not conducted, it is possible that the consideration of capital budgets by the Legislature and the Governor in the next few years will be characterized more by confusion and acrimony than by clarity and accommodation, and neither of the former conditions will serve the goal of developing rational State policy.

The budget proposed for this study is high, and the time to conduct it lengthy, but there is much at stake, not the least of which is the credibility of the process through which a major segment of the State Budget is developed. A comprehensive investigation now, several years in advance of the most pressing needs to house a new generation of students, faculty, and researchers, will obviate many of the problems that could present themselves in only a few years.

Apperdix B *MGT's Executive Summary*

Note: The following material reproduces the text of *Survey of Space and Utilization Standards and Guidelines in the Fifty States*, which MGT Consultants submitted to the Commission on March 31, 1989.

The State of California faces substantial enrollment growth, potentially requiring the addition of several new higher education campuses. The existing space and utilization standards used for facilities planning were established in the late 1940s and mid-1950s and have not undergone a major review since 1966. Since then, only two formal changes have been adopted by the Legislature, one in 1970 and another in 1973, increasing the required hours of use per week for classrooms and teaching labs.

Anticipated enrollment growth, combined with limited financial resources available for new construction, has resulted in significant legislative interest in assuring that California's planning standards accurately reflect space needs. In 1985, the California Legislature directed the California Postsecondary Education Commission (CPEC) to review and evaluate the standards and recommend appropriate changes. After a preliminary study of science and engineering disciplines, CPEC determined that the subject's scope and complexity warranted a comprehensive review with assistance from an outside contractor. MGT was selected to work with CPEC and an advisory committee representing the three segments of public higher education and the executive and legislative branches. The study was conducted in three phases:

- Phase I - A national survey to compare California's space and utilization standards to other states;
- Phase II - A comparison of space inventory systems and room utilization study methods used by California's three segments of higher education; and
- Phase III - A review of changes, impacting space needs, which have occurred in specific disciplines since space standards were established.

This report presents findings from the national survey of space and utilization standards/guidelines.

Scope, Purpose and Definitions

Phase I of the study included a comprehensive review of the facilities budgeting practices of all 50 states. Four types/categories of space were included in the study:

- classrooms,
- teaching laboratories,
- research laboratories, and
- academic offices.

Planning standards for the health sciences, except in community colleges, were excluded from the study.

The purpose of Phase I was to compare California space and utilization standards to the standards/guidelines used in other states. Space standards/guidelines represent square footage allowances to estimate the need for broad categories of space rather than design guidelines which are applied to specific construction projects. A space standard/guideline refers to the number of assignable square feet (ASF) allowed per demand unit for a category of space, such as square feet per student for a classroom or teaching lab; square feet per graduate student for research activities; or square feet per faculty member for office space. A space standard/guideline normally includes space for storage and other support space. *Utilization* standards/guidelines refer to the expected number of hours available classrooms and teaching laboratories will be used each week and the proportion of student stations (the seats in the room) which are expected to be filled.

For classrooms and teaching laboratories, space planning factors are derived using both space and utilization standards/guidelines. A combination of assumptions as to the number of hours per week that rooms will be used and percent of student stations which will be occupied (the utilization components) and the size of the station (the space component), yields a space planning factor per demand unit, weekly student contact hour (WSCH), or student FTE.

No utilization assumptions (standards/guidelines) are applied in planning space for research laboratories or academic offices. Therefore, space planning factors for these categories of space are expressed normally in terms of space per demand unit, e.g., research assistant, FTE faculty, etc.

Methodology

The study included a structured telephone survey of all 50 states, the Province of Ontario and several independent colleges and universities. The purpose of the survey was to identify facilities budgeting processes and determine whether standards/guidelines for the four space categories were used. The telephone survey was followed by site visits to 18 states, four private universities and the Province of Ontario to learn the details of the capital budget processes in higher education systems where space standards/guidelines are widely accepted and used.

To provide meaningful comparisons, information obtained from the survey states was adjusted to normalize the data to California definitions and characteristics. Normalization was achieved by establishing three prototype state higher education systems similar, but not identical to, California's three higher education segments. The standards/guidelines from each state were then applied to the prototype systems to eliminate differences not attributable to the standards/guidelines, themselves.

The use of the three prototypes allowed calculations of classroom and teaching lab space factors, adjusted to:

- reflect discipline and student distributions of enrollment similar to that currently being experienced by the three higher education segments in California;
- reflect the academic year average enrollments used by California (versus the fall term, 12 month average and other enrollment counting periods used by other states); and
- include evening enrollments (versus the exclusion of evening enrollments by some other states).

For research laboratories and office space, where states' standards and formulas varied widely, the chosen unit of comparison was total ASF generated by the application of each state's standards/guidelines to the prototype systems. This simulation approach allowed comparisons of the total space generated by applying each state's formula to the same prototype systems.

The results of Phase I, presented in this report, represent the most comprehensive comparison of higher education space planning factors to be made since standards began being used.

Findings: From the national survey it was learned that:

- Twenty-five states use formal space standards/guidelines in their budgeting process, of which, five states make only limited use of standards/guidelines.
- Only five state legislatures actively use standards/guidelines in making appropriation decisions.
- Most states pattern their space formula and standards after original work done in California in the 1950s and 1960s.
- Eleven states have updated their standards/guidelines in the last five years.

The review of standards/guidelines for classroom space indicates that:

- The formulas used by all states are similar, involving assumptions of the number of hours of room and station use per week and square footage allowances per station.
- The standards/guidelines used by seven states differentiate in their utilization or station size assumptions by either type or size of institution; California does not.

- California's space standards produce significantly less square footage per FTE student or weekly student contact hour than any of the survey states. This is the case for the community college system, state university system and research university system.
- The smaller square footage allowance per student or contact hour resulting from the application of California guidelines is due to the fact that California requires that classrooms be used more hours per week than any other states. The California guidelines also allow somewhat less space per student station.

In the teaching laboratory category, the study found:

- All states estimate the need for teaching laboratories using a formula similar to that used for classrooms, except that the required number of hours of room use per week is lower than that in classroom formulas and expectations for station occupancy are higher.
- Most states apply space allowances per station for instructional laboratories that vary by discipline (e.g., biological sciences, engineering, etc.) and several states, including California, have space allowances that vary by type of institution and/or level of instruction.
- In the state university and research university comparisons, California space standards generate significantly fewer square feet per student (or contact hour) than most states due largely to more stringent utilization expectations.
- Although California utilization requirements for community colleges are higher than utilization guidelines in other states, the California space standards produce a somewhat larger amount of square feet per contact hour than most other states. This appears to be due to greater emphasis on occupational programs in California community colleges which is reflected in standards that provide the larger amount of space needed to carry out these programs.
- The standards/guidelines used by other states contain a specific allowance for graduate level teaching laboratory space in their research universities. State standards for the University of California do not provide a separate allowance for graduate level teaching labs. It is assumed that these space needs will be met by the allowances for research laboratories.

In the case of research laboratories:

- Only thirteen of the nineteen survey states have standards/guidelines for research lab space and the formulas used in those states vary substantially in terms of both demand factors and the discipline categories used.
- California's standards generate somewhat less research lab space than the majority of states and less than the average of the survey states.
- California standards do not specifically recognize grant and contract research personnel, such as post-doctoral fellows, as space demand factors.

The survey findings for academic office space indicate:

- A variety of demand factors are used by the states surveyed to generate allowances for academic offices and administrative support space for academic programs. These range from an allowance for office space applied to student enrollment to allowances per FTE faculty to allowances for each category of staff requiring space.
- In the case of the community college system and the state university system, the California standards generate a smaller amount of square feet than any of the survey states.
- For the research university system, the ASF produced by California standards are below the average of the survey states. California ranks thirteenth of seventeen in this category.

Original work by the states to develop methodologies, formulas and standards/guidelines for use in capital budgeting were based on the predominant characteristics of higher education in the 1950s.

Since then, the majority of states have updated their standards/guidelines and, in some cases, have made major revisions to reflect changing educational program needs. Based on findings from this national survey, an important issue facing California and many other states is the need to ensure that the impact of changes in mission, technology, program needs and external health and safety requirements are taken into account in the standards/guidelines used for capital budgeting.

Appendix C

Research Space Formulas in the States Surveyed by MGT

Personnel Category	Number of Positions Operating Budget A	Number of Positions Operating Budget B	STATE California (A) Formula	California (A) Total ASF	Colorado (A) Formula	Colorado (A) Total ASF	Florida (B) Formula	Florida (B) Total ASF
State Funded								
FTE Faculty	7,600	6,810	125.6 x 7600	1,183,560	92.5 x 7,600	703,000		
FTE Graduate Students								
Graduate I	17,126	17,126	89.2 x 17,126	1,527,689	60.9 x 17,126	1,043,573	41.9 x 17,126	717,579
Graduate II	8,570	8,570	89.2 x 8,570	782,660	60.9 x 8,570	520,695	241.7 x 8,570	2,066,535
FTE Teaching Assistants	2,460	2,460						
FTE Research Assistants	810	810						
FTE Research Technicians	720	720						
FTE Postdoctoral Fellows								
Percent of State Funded Faculty Effort Spent on Research	N/A	30% of 6,810 or 2,043 Faculty FTE					250.7 x 2,043	512,180
Contract and Grant Funded								
FTE Research Faculty	330	1,140			92.5 x 350	32,375	250.7 x 1,140	285,798
FTE Research Assistants	170	170						
FTE Research Technicians	720	720						
FTE Postdoctoral Fellows	1,700	1,700						
Total, Both Fund Categories								
FTE Faculty	7,930	7,930						
FTE Graduate Students								
Graduate I	17,126	17,126						
Graduate II	8,570	8,570						
FTE Teaching Assistants	2,460	2,460						
FTE Research Assistants	980	980						
FTE Research Technicians	1,470	1,470						
FTE Postdoctoral Fellows	1,700	1,700						
Faculty in Departments with Highest Degree								
Doctorate	5,700	5,700						
Masters	1,900	1,900						
Totals	47,836	47,836		5,472,859		2,299,043		3,582,093
Less adjustment for Graduate Teaching Laboratories				374,613		0		0
Net ASF (California)				5,098,246		2,299,043		3,582,093
California Exceeds Other States by:						25.8%		-15.6%

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Personnel Category	Number of Positions Operating Budget A	Number of Positions Operating Budget B	STATE Kansas (B) Formula	Kansas (B) Total ASF	Maryland (A) Formula	Maryland (A) Total ASF	Nebraska (B) Formula	Nebraska (B) Total ASF
State Funded								
FTE Faculty	7,600	6,810					158 x 7,600	1,200,800
FTE Graduate Students								
Graduate I	17,126	17,126	134.5 x	2,179,268	91.9 x 17,126	1,573,879	153.8 x 17,126	2,633,808
Graduate II	8,550	8,550	((17,126 + 8,550)		189.7 x 8,550	1,621,935	153.8 x 8,550	1,314,905
FTE Teaching Assistants	2,460	2,460	- (4 x 2,043))					
FTE Research Assistants	810	810						
FTE Research Technicians	720	720						
FTE Postdoctoral Fellows								
Percent of State Funded Faculty Effort Spent on Research	N/A	30% of 6,810 or 2,043 Faculty FTE	693.0 x 2,043	1,415,799				
Contract and Grant Funded								
FTE Research Faculty	350	1,140	693.0 x 1,140	790,020	189.7 x 350	66,395	158 x 350	55,300
FTE Research Assistants	170	170						
FTE Research Technicians	750	750						
FTE Postdoctoral Fellows	1,700	1,700						
Total, Both Fund Categories								
FTE Faculty	7,950	7,950						
FTE Graduate Students								
Graduate I	17,126	17,126						
Graduate II	8,550	8,550						
FTE Teaching Assistants	2,460	2,460						
FTE Research Assistants	980	980						
FTE Research Technicians	1,470	1,470						
FTE Postdoctoral Fellows	1,700	1,700						
Faculty in Departments with Highest Degree								
Doctorate	5,700	5,700			189.7 x 5,700	1,081,290		
Masters	1,900	1,900			94.85 x 1,900	180,215		
Totals	47,836	47,836		4,385,087		4,523,714		5,204,812
Less adjustment for Graduate Teaching Laboratories				0		0		0
Net ASF (California)				4,385,087		4,523,714		5,204,812
California Exceeds Other States by:				-41.5%		-46.0%		-68.0%

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Personnel Category	Number of Positions Operating Budget A	Number of Positions Operating Budget B	STATE New Hampshire (B) Formula	New Hampshire (B) Total ASF	Ontario (A) Formula	Ontario (A) Total ASF	Oregon (A) Formula	Oregon (A) Total ASF
State Funded								
FTE Faculty	7,600	6,810			176.6 x 7,600	1,342,160	151.0 x 7,600	1,147,600
FTE Graduate Students								
Graduate I	17,126	17,126	119.3 x 17,126	2,043,132	81.7 x 17,126	1,399,194		
Graduate II	8,550	8,550	119.3 x 8,550	1,020,015	81.7 x 8,550	698,535	(see note 1.)	303,465
FTE Teaching Assistants	2,460	2,460					151.0 x 2,460	371,460
FTE Research Assistants	810	810			88.3 x 810	71,523	151.0 x 810	122,310
FTE Research Technicians	720	720			88.3 x 720	63,576		
FTE Postdoctoral Fellows								
Percent of State Funded Faculty Effort Spent on Research	N/A	30% of 6,810 or 2,043 Faculty FTE	284.6 x 2,043	581,438				
Contract and Grant Funded								
FTE Research Faculty	350	1,140	284.6 x 1,140	324,444	176.6 x 350	61,810	151.0 x 350	52,850
FTE Research Assistants	170	170			88.3 x 170	15,011	151.0 x 170	25,670
FTE Research Technicians	750	750			88.3 x 750	66,225		
FTE Postdoctoral Fellows	1,700	1,700			88.3 x 1,700	150,110		
Total, Both Fund Categories								
FTE Faculty	7,950	7,950						
FTE Graduate Students								
Graduate I	17,126	17,126						
Graduate II	8,550	8,550						
FTE Teaching Assistants	2,460	2,460						
FTE Research Assistants	980	980						
FTE Research Technicians	1,470	1,470						
FTE Postdoctoral Fellows	1,700	1,700						
Faculty in Departments with Highest Degree								
Doctorate	5,700	5,700						
Masters	1,900	1,900						
Totals	47,836	47,836		3,969,029		4,868,144		2,023,355
Less adjustment for Graduate Teaching Laboratories				0		0		0
Net ASF (California)				3,969,029		3,868,144		2,023,355
California Exceeds Other States by:				-28.1%		-34.8%		34.7%

1. One third of doctoral graduate students (8,550 x .33) minus one third of FTE teaching assistants (2,460 x .33) times space factor (151.0).

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Personnel Category	Number of Positions Operating Budget A	Number of Positions Operating Budget B	STATE Utah (A) Formula	Utah (A) Total ASF	Virginia (A) Formula	Virginia (A) Total ASF
State Funded						
FTE Faculty	7,600	6,810	675.6 x 7,600	5,134,560		
FTE Graduate Students						
Graduate I	17,126	17,126			99.8 x	1,746,899
Graduate II	8,550	8,550			((17,126+8,550)	
FTE Teaching Assistants	2,460	2,460			- (4 x 2,043))	
FTE Research Assistants	810	810			180 x 810	145,800
FTE Research Technicians	720	720				
FTE Postdoctoral Fellows						
Percent of State Funded	N/A	30% of			503.1 x 2,043	1,027,833
Faculty Effort Spent		6,810 or 2,043			180 x 2,043	367,740
on Research		Faculty FTE				
Contract and Grant Funded						
FTE Research Faculty	350	1,140	675.6 x 350	236,460	503.1 x 350	176,085
FTE Research Assistants	170	170			180 x 350	63,300
FTE Research Technicians	750	750				
FTE Postdoctoral Fellows	1,700	1,700				
Total, Both Fund Categories						
FTE Faculty	7,950	7,950				
FTE Graduate Students						
Graduate I	17,126	17,126				
Graduate II	8,550	8,550				
FTE Teaching Assistants	2,460	2,460				
FTE Research Assistants	980	980				
FTE Research Technicians	1,470	1,470				
FTE Postdoctoral Fellows	1,700	1,700				
Faculty in Departments with Highest Degree						
Doctorate	5,700	5,700				
Masters	1,900	1,900				
Totals	47,836	47,836		5,371,020		3,527,358
Less adjustment for Graduate Teaching Laboratories				0		0
Net ASF (California)				5,371,020		3,527,144
California Exceeds Other States by:				-73.4%		-13.9%

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CALIFORNIA POSTSECONDARY EDUCATION COMMISSION

THE California Postsecondary Education Commission is a citizen board established in 1974 by the Legislature and Governor to coordinate the efforts of California's colleges and universities and to provide independent, non-partisan policy analysis and recommendations to the Governor and Legislature.

Members of the Commission

The Commission consists of 15 members. Nine represent the general public, with three each appointed for six-year terms by the Governor, the Senate Rules Committee, and the Speaker of the Assembly. The other six represent the major segments of postsecondary education in California.

As of February 1990, the Commissioners representing the general public are:

Mim Andelson, Los Angeles;
C. Thomas Dean, Long Beach;
Henry Der, San Francisco;
Seymour M. Farber, M.D., San Francisco;
Helen Z. Hansen, Long Beach;
Lowell J. Paige, El Macero; *Vice Chair;*
Cruz Reynoso, Los Angeles; *Chair;*
Sharon N. Skog, Palo Alto; and
Stephen P. Teale, M.D., Modesto.

Representatives of the segments are:

Yori Wada, San Francisco; appointed by the Regents of the University of California;

Theodore J. Saenger, San Francisco; appointed by the Trustees of the California State University;

John F. Parkhurst, Folsom; appointed by the Board of Governors of the California Community Colleges;

Harry Wugalter, Thousand Oaks; appointed by the Council for Private Postsecondary Educational Institutions;

Joseph D. Carrabino, Orange; appointed by the California State Board of Education; and

James B. Jamieson, San Luis Obispo; appointed by the Governor from nominees proposed by California's independent colleges and universities.

Functions of the Commission

The Commission is charged by the Legislature and Governor to "assure the effective utilization of public postsecondary education resources, thereby eliminating waste and unnecessary duplication, and to promote diversity, innovation, and responsiveness to student and societal needs."

To this end, the Commission conducts independent reviews of matters affecting the 2,600 institutions of postsecondary education in California, including community colleges, four-year colleges, universities, and professional and occupational schools.

As an advisory planning and coordinating body, the Commission does not administer or govern any institutions, nor does it approve, authorize, or accredit any of them. Instead, it cooperates with other State agencies and non-governmental groups that perform these functions, while operating as an independent board with its own staff and its own specific duties of evaluation, coordination, and planning.

Operation of the Commission

The Commission holds regular meetings throughout the year at which it debates and takes action on staff studies and takes positions on proposed legislation affecting education beyond the high school in California. By law, its meetings are open to the public. Requests to speak at a meeting may be made by writing the Commission in advance or by submitting a request before the start of the meeting.

The Commission's day-to-day work is carried out by its staff in Sacramento, under the guidance of its executive director, Kenneth B. O'Brien, who is appointed by the Commission.

The Commission publishes and distributes without charge some 30 to 40 reports each year on major issues confronting California postsecondary education. Recent reports are listed on the back cover.

Further information about the Commission, its meetings, its staff, and its publications may be obtained from the Commission offices at 1020 Twelfth Street, Third Floor, Sacramento, CA 98514-3985; telephone (916) 445-7933.

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California Postsecondary Education Commission Report 90-3

ONE of a series of reports published by the Commission as part of its planning and coordinating responsibilities. Additional copies may be obtained without charge from the Publications Office, California Postsecondary Education Commission, Third Floor, 1020 Twelfth Street, Sacramento, California 95814-3985.

Recent reports of the Commission include:

89-21 State Oversight of Postsecondary Education: Three Reports on California's Licensure of Private Institutions and Reliance on Non-Governmental Accreditation [A reprint of Reports 89-13, 89-17, and 89-18] (June 1989)

89-22 Revisions to the Commission's Faculty Salary Methodology for the California State University (June 1989)

89-23 Update of Community College Transfer Student Statistics, 1988-89: The University of California, The California State University, and California's Independent Colleges and Universities (August 1989)

89-24 California College-Going Rates, Fall 1988 Update: The Twelfth in a Series of Reports on New Freshman Enrollments at California's Colleges and Universities by Recent Graduates of California High Schools (September 1989)

89-25 Overseeing the Heart of the Enterprise: The Commission's Thirteenth Annual Report on Program Projection, Approval, and Review Activities, 1987-88 (September 1989)

89-26 Supplemental Report on Academic Salaries, 1988-89: A Report to the Governor and Legislature in Response to Senate Concurrent Resolution No. 51 (1965) and Subsequent Postsecondary Salary Legislation (September 1989)

89-27 Technology and the Future of Education: Directions for Progress. A Report of the California Postsecondary Education Commission's Policy Task Force on Educational Technology (September 1989)

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89-31 Legislation Affecting Higher Education During the First Year of the 1989-90 Session: A Staff Report of the California Postsecondary Education Commission (October 1989)

89-32 California Colleges and Universities, 1990: A Guide to Degree-Granting Institutions and to Their Degree and Certificate Programs (December 1989)

90-1 Higher Education at the Crossroads: Planning for the Twenty-First Century (January 1990)

90-2 Technical Background Papers to *Higher Education at the Crossroads: Planning for the Twenty-First Century* (January 1990)

90-3 A Capacity for Learning: Revising Space and Utilization Standards for California Public Higher Education (January 1990)

90-4 Survey of Space and Utilization Standards and Guidelines in the Fifty States: A Report of MGT Consultants, Inc., Prepared for and Published by the California Postsecondary Education Commission (January 1990)

90-5 Calculation of Base Factors for Comparison Institutions and Study Survey Instruments: Technical Appendix to *Survey of Space and Utilization Standards and Guidelines in the Fifty States*. A Second Report of MGT Consultants, Inc., Prepared for and Published by the California Postsecondary Education Commission (January 1990)

90-6 Final Report, Study of Higher Education Space and Utilization Standards/Guidelines in California: A Third Report of MGT Consultants, Inc., Prepared for and Published by the California Postsecondary Education Commission (January 1990)

90-7 Legislative Priorities of the Commission, 1990: A Report of the California Postsecondary Education Commission (January 1990)

90-8 State Budget Priorities of the Commission, 1990: A Report of the California Postsecondary Education Commission (January 1990)

90-9 Guidelines for Review of Proposed Campuses and Off-Campus Centers: A Revision of the Commission's 1982 *Guidelines and Procedures for Review of New Campuses and Off-Campus Centers* (January 1990)

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